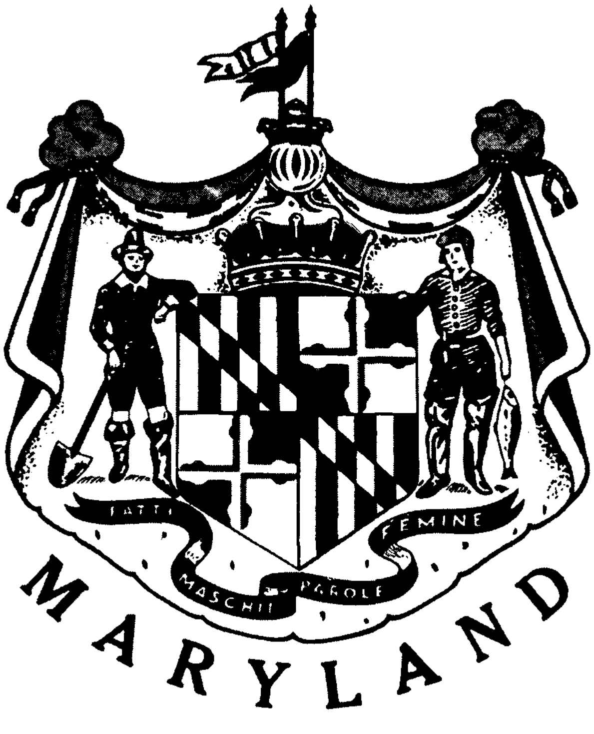
AN OVERVIEW OF AIR AND SOLID WASTES ENVIRONMENTAL QUALITY IN MARYLAND



March 1973

A report by the

ENVIRONMENTAL QUALITY COMMITTEE

of the

GOVERNOR'S SCIENCE ADVISORY COUNCIL

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Mr. Martin Meyerson, Chairman
Environmental Quality Committee

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A. INTRODUCTION

Completion by the Environmental Quality Committee, Governor's Science Advisory Council of its first report dated January 1971, entitled: "Some Technology Considerations For Environmental Quality in Maryland," Library of Congress Catalogue No. 72-636153, and presentation of same to the Governor and to Cabinet agencies during 1971 resulted in important actions, and in continuing interest in additional studies of Maryland's environment.

Actions resulting from the Committee's first study included efforts by the Department of Natural Resources to better define and set priorities for its environmental quality technology needs; by the Department of Health and Mental Hygiene and Maryland Environmental Service to expand their solid wastes recycling activities, and hazardous wastes evaluations; and by the Department of Personnel to remove some constraints to State professional staffing associated with environmental quality operations.

This report is the result of the Committee's part-time activities in 1972 to attempt to provide an overview audit of Maryland's environmental quality in air and solid wastes quality. Specifically the Committee attempted to answer the following questions posed late in 1971 by Governor Mandel.

1. What is the current state of Maryland's environmental quality?

2. Is it better or worse than some prior period?

3. What are the future trends?

4. Is Maryland going too far in its environmental quality regulatory activities? Or not far enough?

5. What are the remaining important challenges, and how should they be handled, particularly insofar as technology is concerned?

The challenge of answering these important questions was enormous, particularly by a part-time technical Committee. Yet, the questions are significant to policy makers and need to be answered succinctly and objectively. Accordingly, the Committee reviewed available data, interviewed many State and Federal personnel, and made the findings and recommendations noted herein.

The Committee concentrated on an overview audit of air quality which was evaluated by major pollutants in each region of the State. And solid wastes quality evaluations concentrated on municipal, industrial and sewage solids.

No detailed studies were made of the adequacy of environmental quality standards; of the effectiveness of specific environmental quality programs, or institutions implementing those programs; or of the benefits of many resource allocation policies. These were considered beyond the scope of the Committee's activities and available energies.

The audit of environmental quality is obviously only one of many environmental quality issues requiring State consideration and action. There are many others. However the Committee considers this issue significant and substantive enough that positive State actions now could help prevent important problems in the future.

Overall findings and recommendations of the Committee studies are summarized next in Section IB, while the studies themselves together with detailed analyses, conclusions and recommendations are found in Section II.

B. FINDINGS AND RECOMMENDATIONS

1. Overview

A succinct answer to Governor Mandel's questions is provided to establish the theme for subsequent more detailed findings and recommendations.

Question 1. What is the current state of Maryland's environmental quality?

Answer 1. On an integrated, State-wide basis Maryland's current environmental quality appears adequate for the health and welfare of its citizens.

Question 2. Is the current state of Maryland's environmental quality better or worse than some prior period?

Answer 2. Regulatory activities have materially improved air and solid wastes environmental quality over the past 5 years.

Question 3. What are the future trends in Maryland's environmental quality?

Answer 3. Air quality will continue to improve, but new transportation strategies may be required in Metropolitan areas to meet Federal air ambient standards.

Solid wastes quality may get somewhat worse until better controls are established for hazardous wastes and sewage solids.

Question 4. Is Maryland going too far in its environmental quality regulatory activities? Or not far enough?

Answer 4. To date Maryland's environmental quality regulatory activities have kept pace with increasing challenges. It is expected that air quality regulations on stationary sources will relax somewhat in the future, in order to accommodate the energy crisis. A significant tax on gasoline, or rationing, would help reduce air pollutants in metropolitan areas. Solid wastes regulatory activities have been adequate, particularly with the recent intorduction of recycling legislation.

On balance, Maryland's economy does not appear to have suffered adversely from its environmental quality regulatory activities.

Question 5. What are the remaining important environmental quality challenges, and how should they be handled, particularly insofar as technology is concerned?

Answer 5. New transportation strategies will be required in Metropolitan areas to meet Federal ambient air standards.

The identification and control of hazardous wastes, and the effective disposal of sewage solids will require increasing attention.

2. Air Quality

Findings

1) Maryland adopted its first Statewide air quality control regulations in March 1968, with subsequent additions and amendments, and a positive correlation with cleaner air is evident since that time. Most pollution sources are in compliance with regulations, or on a firm schedule leading to compliance in the near future.

2) Total annual suspended particulate matter concentrations are currently lower in all regions than 1964-1968 values, and only slightly exceed Federal/State ambient standards in Western Maryland and Metropolitan Baltimore at this time. It is anticipated that concentrations will decrease further by 1975, and will come as close to meeting Federal/State ambient standards, as practical operations will allow, considering natural ambient conditions.

3) Total annual sulfur dioxide concentrations are currently significantly lower in all regions than 1964-1968 values, and meet Federal/State ambient standards in all regions. Concentrations are expected to decrease further by 1975.

4) Total annual concentrations of nitrogen dioxide, carbon monoxide, and photochemical oxidants caused primarily by automobile emissions are currently lower than pre-1968 values but generally exceed Federal/State ambient standards primarily in Metropolitan Baltimore and Metropolitan Washington areas. Concentrations are expected to decrease further by 1975, but Federal/State ambient standards will probably still not be met in metropolitan areas without major changes in motor vehicle travel strategies.

5) Capital expenditures for air pollution abatement (by major stationary sources) are estimated to have been approximately $72M by 145 establishments over the past four years of regulation implementation. Additional capital expenditures through 1975 are estimated to vary between $58M and $148M for stationary sources depending on whether power plants convert to fuel oil from coal, or install stack gas desulfurization equipment while continuing to use coal. Power companies, steel companies, and chemical process companies provide the bulk of air pollution, and pollution abatement capital expenditures.

On balance, those expenditures seem to be able to be accommodated in the socio-economic arena without serious consequences, and are able to provide adequately "clean" air.

6) Control of motor vehicle emissions will require annual consumer expenditures of up to about $70 million per year for 1976 automobiles in Maryland, in addition to about $25 million per year for lead-free gasoline at that time. Changes in motor vehicle travel strategies, annual inspections, control of heavy duty vehicles, control of other sources of hydrocarbons, and expanded use of public transit systems will cost even more, but these enormous costs were not estimated by this Committee. EPA estimates that the U.S. may spend between $11 billion and $71 billion to clean up carbon monoxide and oxidant emissions from automotive engines between 1975 and 1985. The cost will vary from $11 billion if engine modifications are used, $41 billion if oxidation catalysts are used, and $71 billion if the questor system is used.

On balance, it is not clear how these large expenditures will be accommodated in the socio-economic arena, particularly since "clean" air will not be available in metropolitan areas without concommitant major changes in transportation strategies.

Recommendations

1) Maryland should continue its air quality compliance activities for stationary sources since practical technology and reasonable economics will provide acceptably "clean" air in the foreseeable future. But some relaxation on a case by case basis may be necessary to help alleviate the energy crisis.

2) Maryland should carefully follow Federal activities to reduce automobile emissions, but should concentrate on systems and strategies to reduce or replace motor vehicle travel in congested metropolitan areas.

3. Solid Wastes Quality

Findings

1) Almost 4 million tons per year of solid wastes are generated in Maryland which require major disposal activities (e.g. incineration, sanitary landfill, or dumps). About 2/3 of this total is generated and disposed of in urban areas and 1/3 in rural areas. Solid waste disposal capacities and activities have been broadly keeping pace with increasing generation quantities to date.

Disposal capacities to 1975 appear generally adequate to handle increasing quantities of conventional solid wastes in essentially all political jurisdictions with currently understood plans for additional sanitary landfills, improved incinerators, and at least one or more major volume reduction centers (e.g. the currently approved 1000 ton per day pyrolysis plant in Baltimore).

2) Uncontrolled burning of refuse which was found in almost 40% of all land disposal sites in 1968, has been essentially eliminated at this time. And where almost 35% of all land disposal sites were located in marshlands, tidelands and flood plains causing potential water pollution problems, these have been decreased considerably.

Current findings indicate that almost 50% of the solid wastes are disposed of in sanitary landfills; almost 30% by incineration; and about 10% in dumps. By 1975, it is anticipated that, at least in a few major urban areas where "crunches" could exist, sanitary landfills will dispose of about 15% of the solid wastes; incineration, about 35%; and the remaining 50% by major volume reduction (e.g. pyrolysis) or recycling. This is the proper direction for the future.

3) Two critical solid waste categories require special attention for the future-hazardous wastes and sewage solids. Where industrial and institutional (e.g. medical) wastes currently account for almost 40% of the total solid wastes generated, particularly in urban regions, the nature of their wastes may become more hazardous in the future, regardless of their volume, requiring special collection and disposal techniques. And where sewage solids presently account for about 13% of the total solid wastes generated, tighter water quality regulations will surely increase this volume, and make current disposal techniques (e.g. land storage, or water dumping) unacceptable.

The Committee had recommended a hazardous waste study in its last report, and this has still not been completed by the State. Use of sewage solids (sludge) as soil nutrients or as fuel in co-located power/waste treatment plants (e.g. as considered in the study of co-locating the Montgomery County Advanced Waste Water Treatment Facility with the PEPCO Dickerson Power Facility) are being studied, and this is appropriate. But such use may be too little or too late unless additional uses are evaluated, or sludge reduction technology is better assessed.

Recommendations

1) Maximum use be made of the Environmental Protection Agency's studies of hazardous wastes. However, State agencies should survey Maryland's specific current and expected sources of hazardous wastes, current and proposed disposal methods, and relative hazards.

2) The current studies of sewage waste generation and disposal should be expanded to include the impact of tighter water quality regulations.

II. TASK STUDIES

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IIA. AIR QUALITY

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I. Introduction

A major national concern for the 1970's has been the degradation of the environment. Newspapers and television documentaries detail the grim story of blight, pollution and the ensuing environmental crisis. The environmental problems being highlighted are complex, pervasive, know no boundaries and cannot be changed overnight by some dramatic technical solution. They also cannot be changed simply by spending money or enacting laws. Any serious effort to restore the quality of our environment will require everyone's efforts and will involve new roles for government, business, and the private citizen.

Since the air pollution problems are national in scope it is not surprising that the Federal government has taken the initiative to eliminate causes of pollution and has promulgated national ambient air quality standards for sulfur oxides, particulate matter, carbon monoxide, photochemical oxidants, hydrocarbons and nitrogen dioxide. The 1970 Clean Air Act reauired each state to adopt and submit a plan providing for the implementation, maintenance and enforcement of the standards within the State. Prior to this Federal enactment, the State's Bureau of Air Quality Control had taken positive steps to eliminate causes of pollution and this report notes the progress made to date.

2. Findings

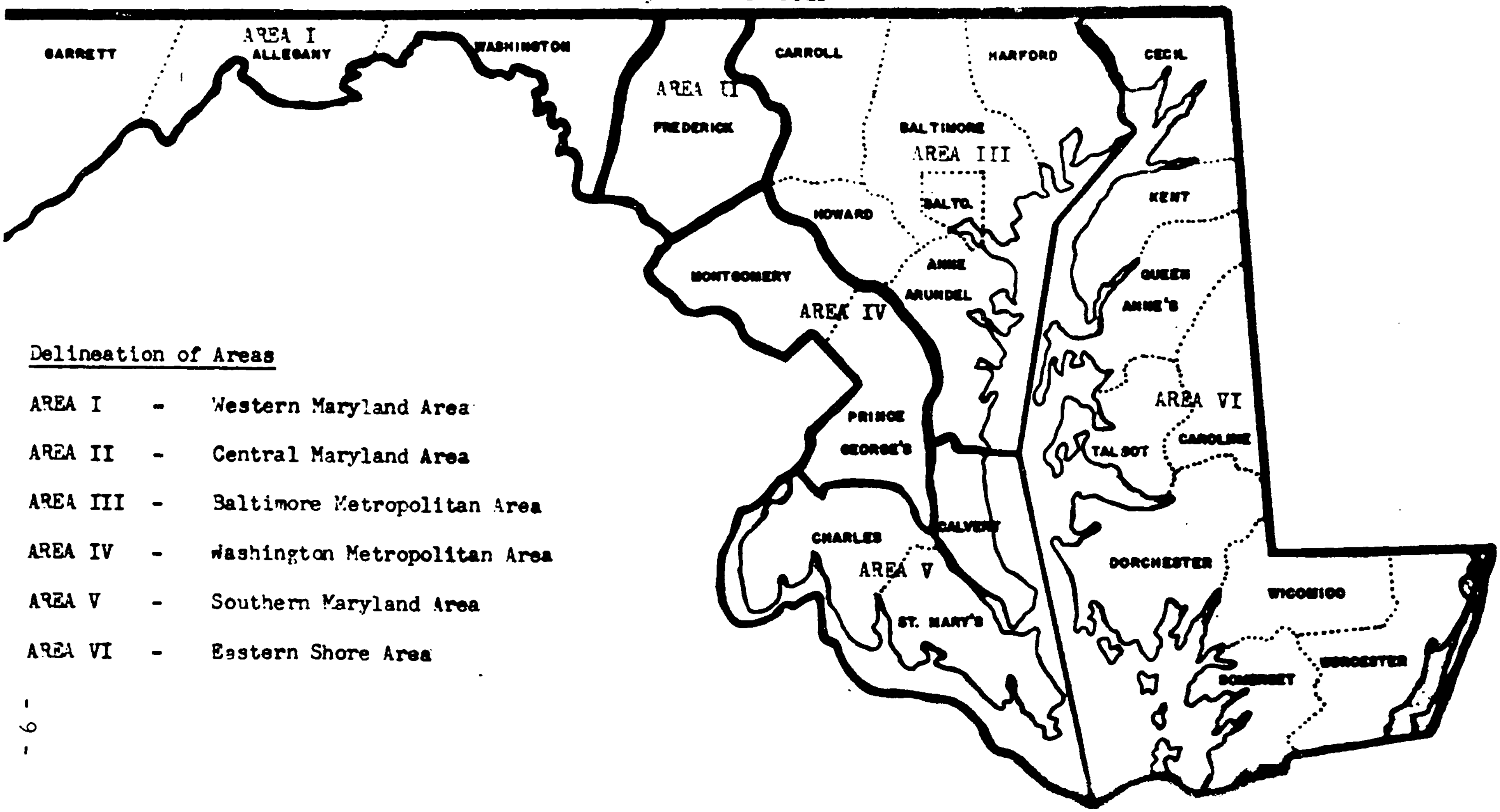
In order to answer the question concerning the status and trends in the quality of air in Maryland, some comparisons of quantitative data for different time periods and areas within the State are described.

a. Air Quality Areas

Maryland is divided into six air quality control areas which correspond exactly with the six Federally designated air quality control regions in the State (see Figure 1). Area I includes Allegany, Garrett and Washington Counties; Area II, Frederick County; Area III, Baltimore City and Anne Arundel, Baltimore, Carroll, Hartford and Howard Counties; Area IV, Montgomery and Prince George's Counties; Area V, Calvert,

Figure 1

Maryland State Air Quality Control Areas



Delineation of Areas

AREA I - Western Maryland Area

AREA II - Central Maryland Area

AREA III - Baltimore Metropolitan Area

AREA IV - Washington Metropolitan Area

AREA V - Southern Maryland Area

AREA VI - Eastern Shore Area

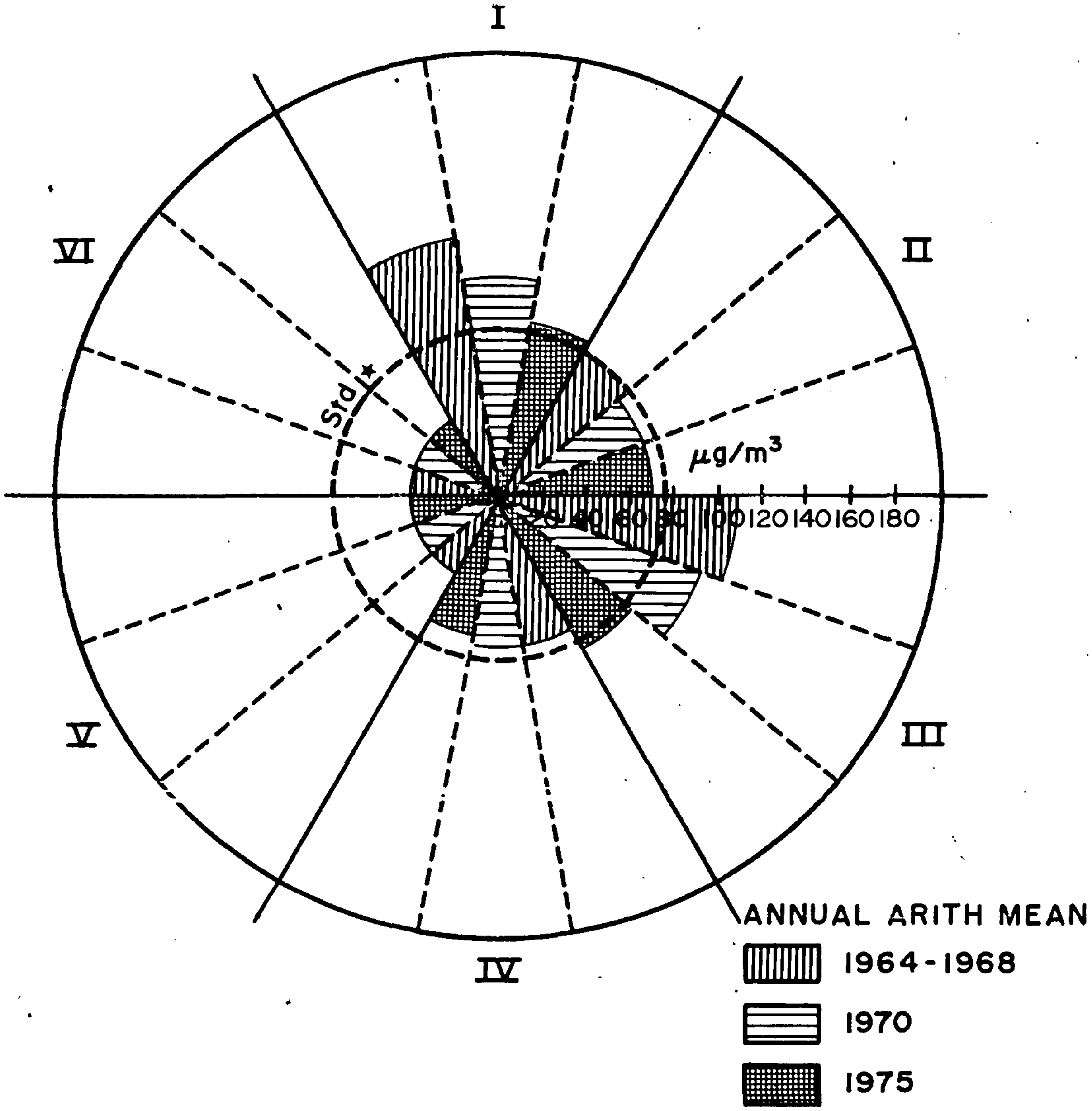
Charles and St. Mary's Counties; and Area VI, Caroline, Cecil, Dorchester, Kent, Queen Anne's, Somerset, Talbot, Wicomico and Worcester Counties. Sampling stations have been located within areas at locations that reflect general ambient air quality or where a high air pollution potential exists. It is important to bear in mind that sampling data obtained at one site are not necessarily representative of the general air quality for an entire community or area. However, in order to provide a better geographical picture of the air quality throughout Maryland and their trends, general averaging of the various data sources from within an area are presented. To make comparisons easier, the six air quality control areas will be presented as segments of a circle. Comparative data for three time periods, 1964-1968, 1970 and projected for 1975 will be presented, where available, for each area. The State and Federal ambient air quality standard is denoted by an asterisk, *.

b. Particulates

In Figure 2, the gross annual arithmetic mean of suspended particulate matter for the six designated areas and time periods are presented. Several observations can be made. First, only two areas, I and III, have suspended particulate matter levels greater than the ambient air quality standard. Second, in each of these areas there has been roughly a 20% decrease in level in the 1968-68 and 1970 readings. Since air quality is directly related to the emission rates of pollutants, this marked decrease can be attributed to the implementation of State regulations which require the use of the best available emission control technology. The Bureau of Air Quality Control has registered more than 12,000 stationary sources of air pollution. By means of this registration real or potential violators can be readily located. The Bureau has also used this program to design additional control regulations, make pollutant emission inventories, develop long-range air quality control plans, and maintain surveillance of pollutant emissions. It is projected that by 1975 the particulate levels in Areas I and III will be reduced to the standards as the remaining small coal-fired space heating plants are replaced with gas and oil-fired plants, industrial abatement activities now in progress come to completion, small incinerator phase-out programs are completed and dust collectors are installed. Additionally, open burning of refuse has been greatly reduced and the burning of scrap motor vehicle hulks for salvage purposes has been virtually eliminated. An estimated 100-150 million dollars are being expended by industry to comply with the Maryland standards for particulate matter.

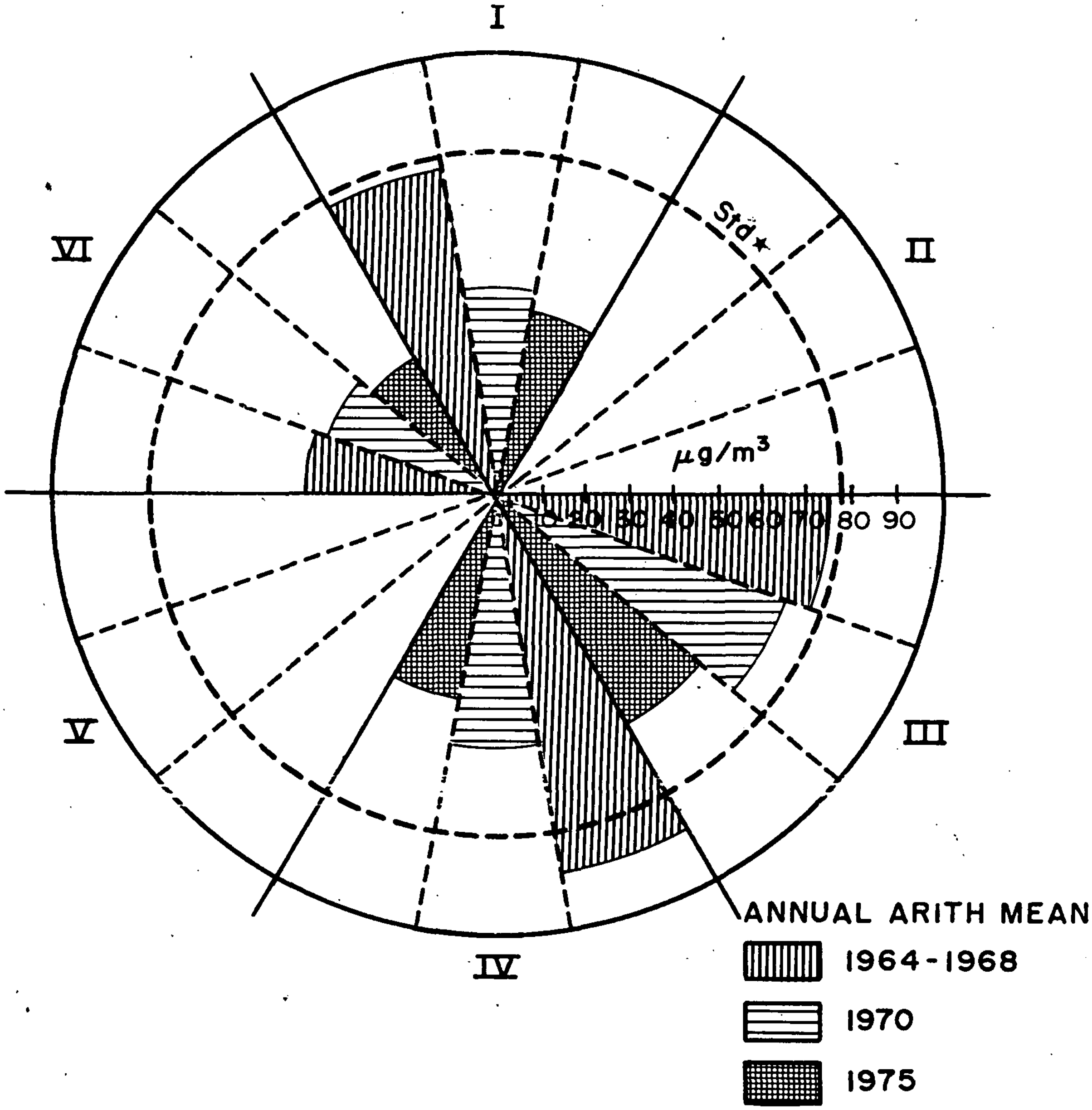
e. Sulfur Dioxide

The annual arithmetic mean of sulfur dioxide concentrations throughout the various areas of the State are presented and compared in Figure 3. Several facts are clearly evident. Only three areas in the State have any appreciable concentration of sulfur dioxide and in



AREA I - WESTERN MARYLAND
AREA II - CENTRAL MARYLAND
AREA III - BALTIMORE METROPOLITAN
AREA IV - WASHINGTON METROPOLITAN
AREA V - SOUTHERN MARYLAND
AREA VI - EASTERN SHORE

Figure. 2. Total Suspended Particulate Matter



AREA I - WESTERN MARYLAND
AREA II - CENTRAL MARYLAND
AREA III - BALTIMORE METROPOLITAN
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Figure 3. Sulfur Dioxide

each of these areas there is a marked decrease in SO_2 concentration since 1970. This marked reduction can be attributed to the fact that since 1970 the sulfur content of residual fuel oil has been limited to not more than 1% from the previous unregulated level of about 2.2%. Regulations have also limited the sulfur content of coal to 1%, this being a reduction from the former 2 to 3%. Additional reductions in the SO_2 level are also being achieved by the installation of stack gas desulfurization equipment. Additionally, substantial reductions in SO_2 have been achieved by conversion of coal-firing to low sulfur oil-firing or gas and distillate oil-fired heating in power plants. All in all, it appears that all regions of Maryland are achieving the SO_2 standard.

d. Photochemical Oxidants, Carbon Monoxide, Nitrogen Dioxide

Where large stationary fuel burning installations are the chief source of particulate matter and sulfur dioxides pollutants, motor vehicles, particularly gasoline engines, are the major source of hydrocarbons, carbon monoxide, photochemical oxidants and oxides of nitrogen. This being the case, it is not too surprising, therefore, that the only regions in the State where these particular pollutants cause a serious environmental concern are the highly populated (people and automobiles) urban areas, Areas III and IV, as noted in Figures 4, 5, and 6. Very little reliable historical data are available to show trends in these pollutant concentrations, except in the Washington and Baltimore metropolitan areas; high concentrations are not expected in the other areas because of their relatively small population.

To further compound the comparison difficulties, even the pollutant data which are available in Areas III and IV are suspect due to the unreliable analytical techniques used throughout the years in measuring the concentrations of photochemical oxidants, nitrogen oxides and carbon monoxides. Bearing these points in mind, the current and predicted levels of pollutants in the Washington and Baltimore areas are as follows:

	Area III (Washington)				Area IV (Baltimore)		
	< 1970	1970	Estimated 1975	Std.	< 1970	1970	Estimated 1975
a) Photochemical Oxidants (1-hour maximum)	--	380	190	160 $\mu g/m^3$	390	400	180
b) Carbon Monoxide (8-hour maximum)	--	21	16	10 mg/m^3	27	24	17
c) Nitrogen Dioxide (Annual Arith. Mean)	--	160	150	100 $\mu g/m^3$	200	190	160

This comparative data is also presented in Figures 4-6. From these data it is clearly evident that a serious pollutant problem exists in the two metropolitan areas.

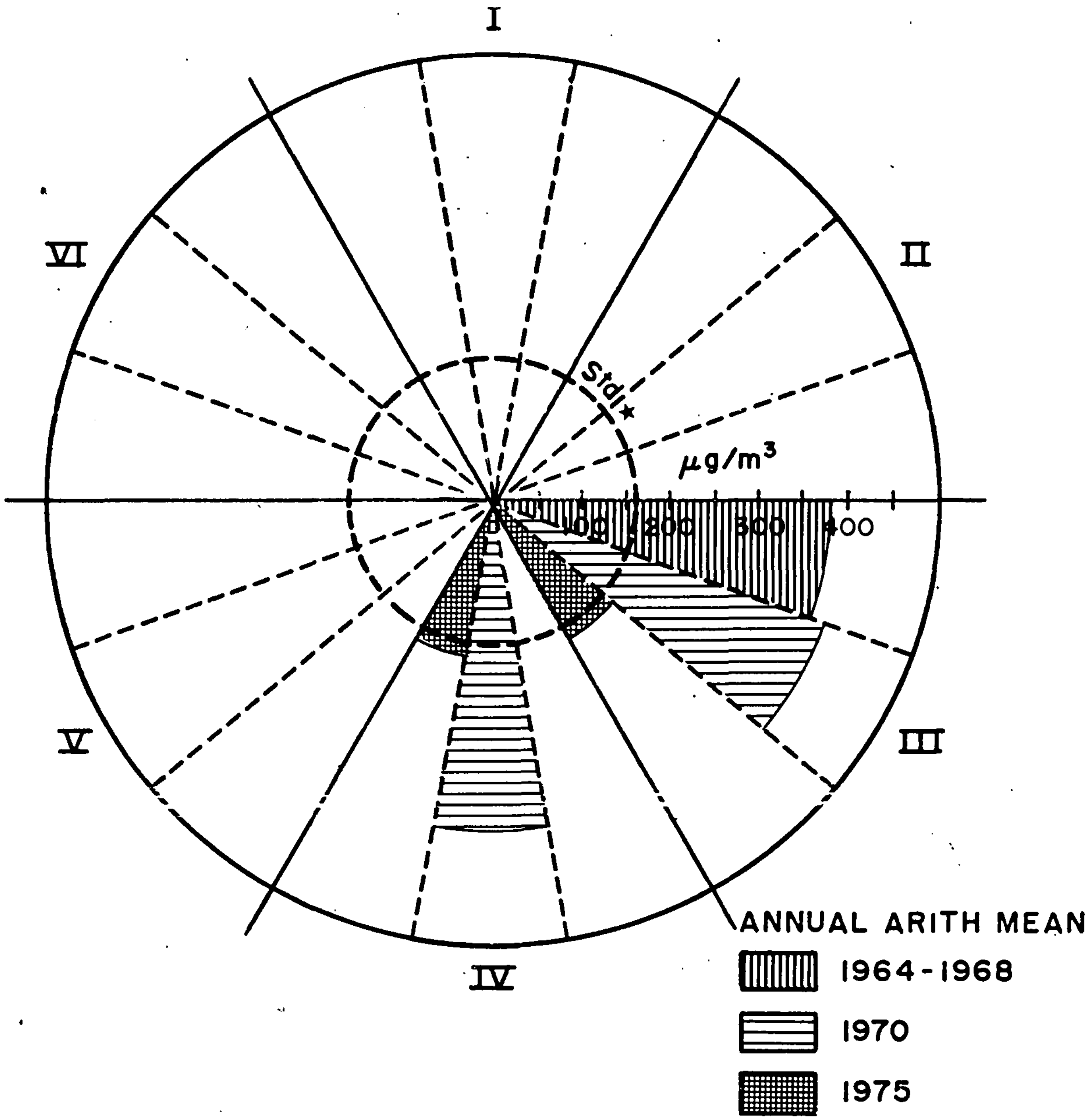
It is unfortunate that the automobile industry did not recognize or show due concern for the role of the automobile exhaust in causing degradation of the atmosphere. Emissions from uncontrolled automobiles, as manufactured prior to 1968, came from the crankcase blowby gases, fuel evaporation from the fuel tank and carburetor, and the engine exhaust. The emissions from the engine exhaust are a consequence of the conditions of the combustion process occurring inside the engine cylinder. Hydrocarbons (HC) and carbon monoxide (CO) results from the incomplete combustion of the fuel-air mixture; oxides of nitrogen (NO_x) form at the high-temperatures of the combustion process and are emitted in the exhaust. Unfortunately, as improvements in engine design are made to reduce the CO concentration, the concentration of NO_x in the exhaust increases. The Federal government sensing the need for urgent pollution control from automobile emissions adopted the following control standards and timetable.

Federal Emission Control Requirement for Light-Duty Vehicle

Model Year	Pre 1968	1968	1970	1971	1975	1976
Emissions g/mile						
HC	10	3.4	2.2	2.2	0.41	0.41
CO	77	3.5	2.3	2.3	3.4	3.4
NO_x	6	NR	NR	NR	3.0	0.4

NR = No Requirement

The Clean Air Amendments of 1970 have had the effect of accelerating progress by automobile manufacturers in emission control. Substantial reductions in HC and CO exhaust emissions have been brought about by engine-design modifications, changes in engine-operating conditions such as leaner fuel-air mixtures, reduced engine compression ratio, improved cylinder head design and retarded spark timing. In spite of these improvements there is a need for much more sophisticated engines, including catalytic converters to achieve the emission levels required in the Act for 1975 vehicles. It appears most unlikely that any manufacturer will be able to meet the in service requirements of the Act, unless regular periodic maintenance of the emission control system is required of the owner. The technology necessary to meet the 1976 standards, especially the catalyst suitable for NO_x reduction, is currently available on a limited supply basis. There is a distinct difference between the ability to synthesize prototype



AREA I - WESTERN MARYLAND

AREA II - CENTRAL MARYLAND

AREA III - BALTIMORE METROPOLITAN

AREA IV - WASHINGTON METROPOLITAN

AREA V - SOUTHERN MARYLAND

AREA VI - EASTERN SHORE

Figure 4. Photochemical Oxidants

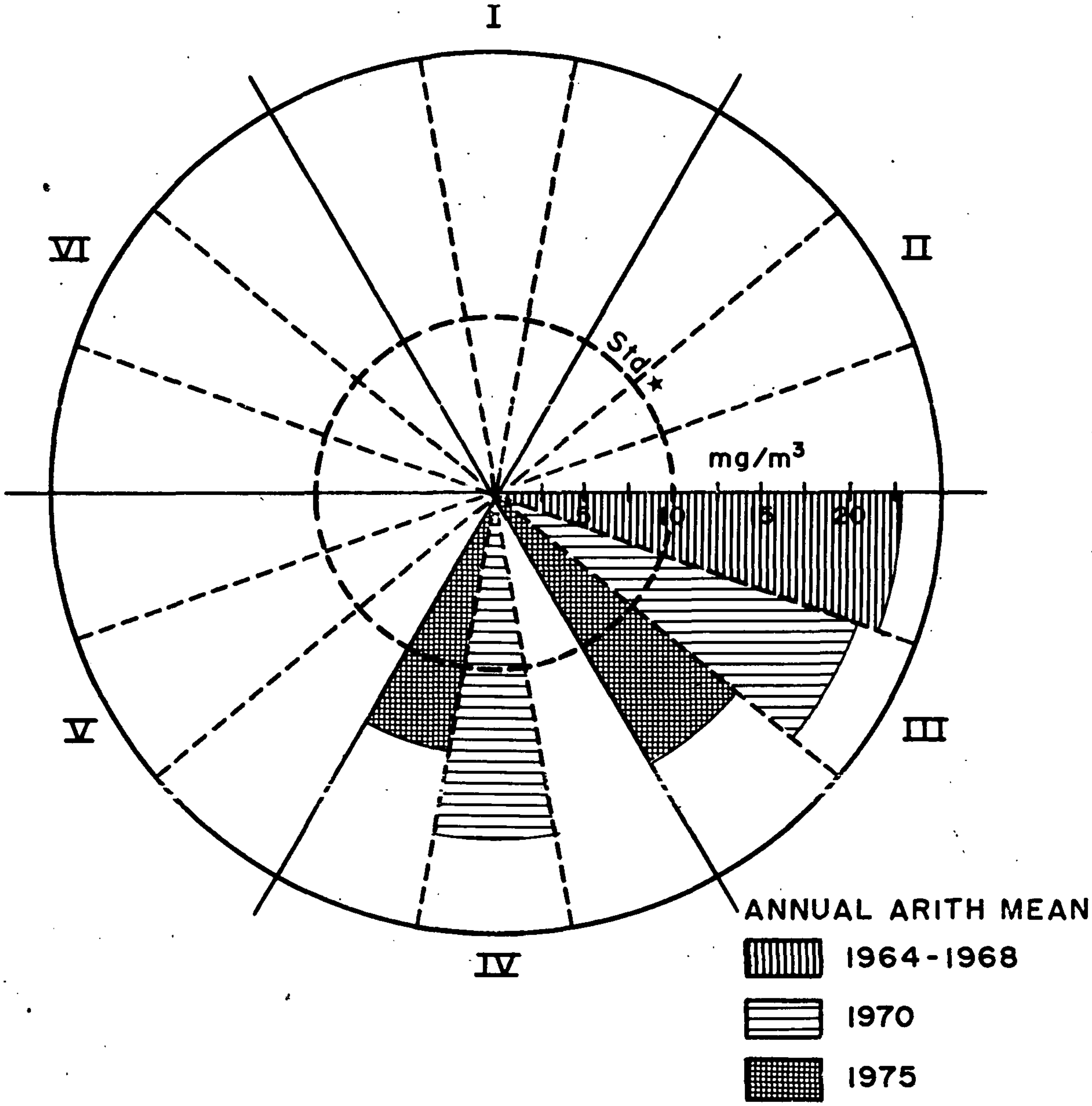


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Figure 5. Carbon Monoxide

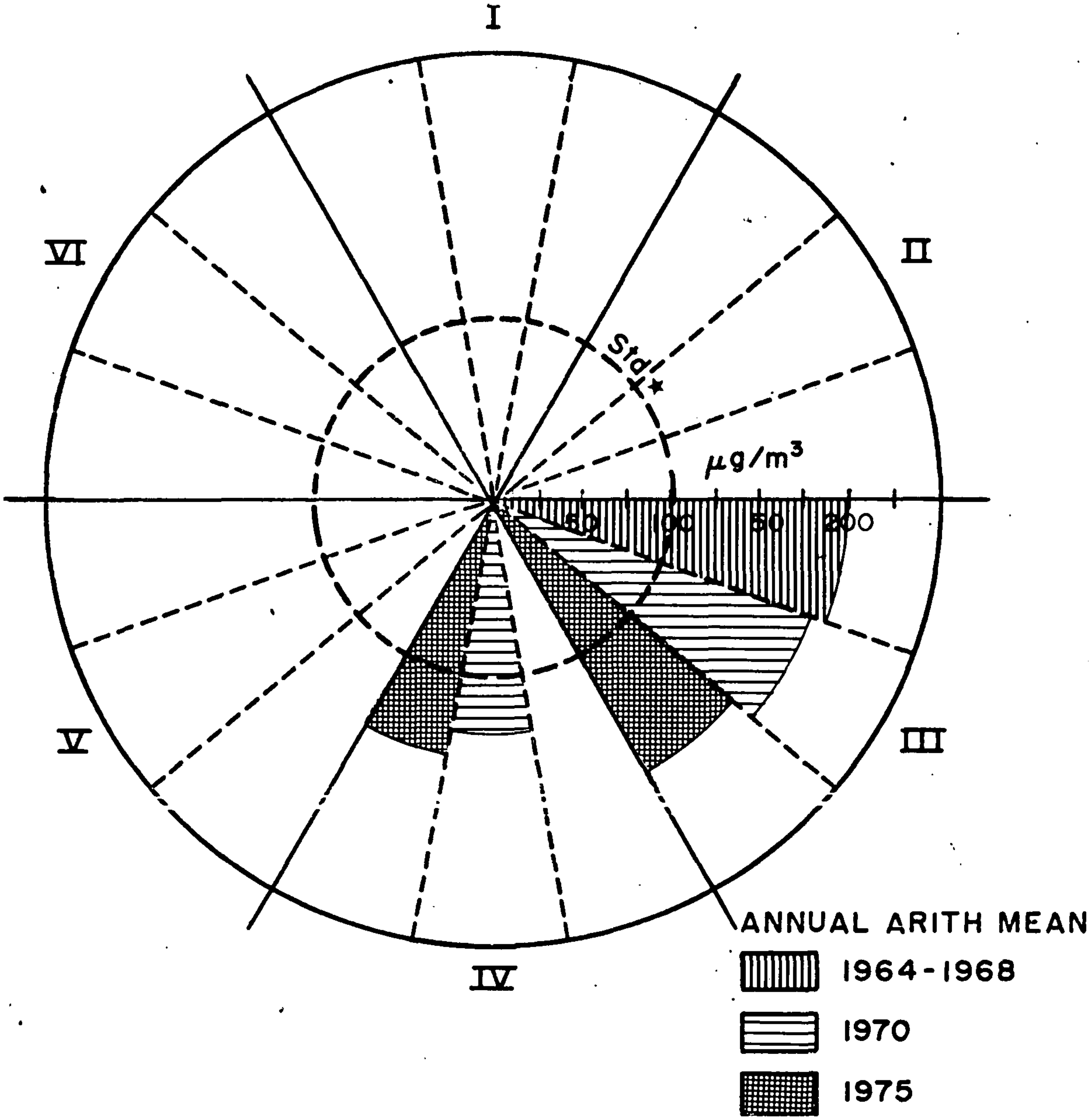

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Figure 6. Nitrogen Dioxide

automobiles which can be certified to meet the Federal emission standards and the ability to mass produce them within the time frame prescribed by the recent legislation.

The Federal Government has encouraged states to adapt meaningful and uniform emission inspection programs by making grants available to state air pollution control agencies in amounts up to two thirds of their program. New Jersey has taken advantage of this aid and has developed a pilot project at two different locations designed to help fill the state's air pollution control objectives. Tests for carbon monoxide and hydrocarbon emissions are being performed as part of the routine yearly car inspection. By integrating the emission inspection tests along with the safety tests a most economical and advantageous program results. This yearly pattern is ideal since it permits checking of an engine's performance approximately every 10,000 miles. This conforms reasonably well with the manufacturer's tune-up requirements and the air pollution reduction benefits realized by this type of inspection would be cumulative over the vehicle's life. The simple idle surveillance test currently utilized in New Jersey correlates reasonably well with the 7-mode test currently used for the manufacturer's vehicle certification; this idle test does not, however, correlate with the EPA test procedure to be used for 1975 model year vehicles. The technology for testing according to these prescribed procedures requires expensive equipment and instruments -- generally more characteristic of a laboratory rather than a production line or state inspection station. In view of this difficulty and the vagaries of Federal Government policies it would appear much wiser for Maryland to proceed with caution in planning statewide emission inspection stations. Most basic research and testing of advanced systems involve substantial costs that may well be beyond the capacity of the State to fund. It would be prudent, however, to carefully monitor the ongoing pilot programs of testing consumer-owned vehicles in New Jersey and California.

The 1975 vehicle performance is likely to be adversely affected as a consequence for the need of an oxidation catalyst to control HC and CO, a reduction catalyst or exhaust gas recycle or both to control the NO_x to meet the 1975 emission standards. Performance areas most affected are the fuel economy, vehicle acceleration and vehicle driveability at various operating modes and ambient conditions. Also the estimated cost to the consumer includes an increase in sticker price of about $200, 3 to 12 percent increase in consumption of a more costly fuel which must be low in lead, sulfur and phosphorus, and an increase in maintenance cost.

In spite of the reduction in automotive emissions expected through technological advances in engine design and various control devices, other nontechnological events are tending to counteract these advances. From data previously presented it is quite evident that air pollution is a regional problem. In Maryland, over 75 percent of the population is concentrated in a single urban complex -- the Baltimore-Washington urban corridor. Not unlike other areas in the United States, there has been a decided shift from rural agricultural living and employment to urban manufacturing and service employment. To complicate the situation still further the motor vehicle registration growth rate has been twice that of the population growth. The greatest volume of travel is consequently on a relatively small part of the State's highway network and at present 95 percent of the travel within this area is by the motor vehicle. Therefore, if there is any hope of achieving an air pollution level below the ambient standards it is imperative to devise stratagems to reduce motor vehicle travel in the metropolitan Baltimore-Washington corridor. A systematic approach for the rapid and "inexpensive" movement of people and goods must be developed -- systems which effectively integrate all modes of transportation and which exploit the unique efficiences and advantages of each method.

A number of strategems to reduce motor vehicle emissions are possible:

a. Reduce traffic congestion.
   (1) Staggered work hours.
   (2) Four day work week.
   (3) Ramp metering on freeway out-ramps.

b. Reduce concentrated pockets of polluted air.
   (1) Increase parking fees to discourage downtown parking.
   (2) Traffic free zones.
   (3) Consideration of terrain topography in highway location policy.
   (4) Two-car stretegy -- use a high cost, low emission automobile for those regions in which automotive pollutants are of major importance and a lower cost, higher emission vehicle for those areas where air quality would not be degraded by these less controlled vehicles.

c. Reduce number of miles driven .
   (1) Facilitate car pooling with computer matching programs.
   (2) Mass Transit - rapid transit and upgrade commuter rail service.
   (3) Better urban planning - reduce distance between work and homes.
   (4) Encourage bus travel with lower fares.
   (5) Encourage walking.
   (6) Encourage cyclists with bikeways and bike racks.

(7) Charge tolls to motorists using congested roads at peak hours.

(8) Increase gasoline taxes for stations in urban areas.

(9) Impose pollution tax on motor vehicles as a function of size of engine and miles drive.

d. Encourage the use of smaller automobiles.

3. Recommendations

a. Before embarking on a State-owned motor vehicle inspection system in Maryland, monitor closely the progress and effectiveness of the integrated safety and auto emissions inspection programs in New Jersey and California. Determine those parameters which should be differentiated in the establishment of State's standards and which would also provide diagnostic information to pinpoint the engine malfunction area to the owner.

b. Devise various strategies to reduce the motor vehicle miles traveled in the metropolitan Baltimore-Washington corridor. An effective, but expensive, rapid rail mass transit system could be developed.

c. State regulatory agencies already in existence should continue to keep constant surveillance on potential industrial polluters -- there should be no hesitation to encourage reluctant industries to make use of technology available for pollution abatement.

d. Sponsor an educational campaign for the general public to make them cognizant of the need for the proper maintenance of their motor vehicles to achieve the goal of abatement of pollution created by the motor vehicle.

e. Develop reliable baseline environmental data for the various pollutants so that trends can be more readily ascertained and the relative health damage caused by the different air pollutants determined.

f. Be aware of technological breakthroughs of alternate power systems and the potential they offer for emission reduction over that of the conventional engines, particularly for use in the highly traveled metropolitan corridor.

4. Discussion

a. AMBIENT AIR QUALITY STANDARDS

National primary and secondary ambient air quality standards have been established by the Environmental Protection Agency. The Maryland State Department of Health and Mental

Hygiene established ambient air quality standards for sulfur oxides and particulate matter prior to the time the Federal Government promulgated its standards for those pollutants. Therefore, there are some differences between the national and state standards for these two pollutants. At a more recent time, the Federal Government promulgated its standards for carbon monoxide, hydrocarbons, nitrogen dioxide, and photochemical oxidants. The Department of Health and Mental Hygiene having no basis for disagreeing with these standards, adopted its own standards which are identical to those adopted by the Federal Government. These standards are all shown in Table 1.

Justification for these standards is a complex issue, and is beyond the scope of this study. Hence, the following discussion evaluates air pollution in terms of the noted standards, and does not attempt to evaluate the standards themselves.

b. THE STATUS OF POLLUTION LEVELS IN MARYLAND

1) Particulate Matter

Area I - Western Maryland

Particulate matter has been measured for a long period of years in Cumberland and Hagerstown. In Cumberland, particulate levels for the 1968-71 period averaged 110 micrograms per cubic meter as compared to 138 micrograms per cubic meter during 1964-67. This indicates a 29% reduction in man-made pollution for the two periods (man-made pollution is considered to be all particulate matter in excess of a natural background of 40 micrograms per cubic meter caused by pollen, sea spray, dust storms, volcanic eruptions, etc.). The levels presently are in the range of 110 micrograms per cubic meter which is still much in excess of air quality standards. In Hagerstown, particulate levels averaged 108 micrograms per cubic meter during 1964-1967 and 77 micrograms per cubic meter during 1968-1971. This indicates a reduction of about 45% in man-made pollution for the two periods. Present levels average about 77 micrograms per cubic meter, slightly in excess of the serious level standard. In the Luke-Bloomington-Westernport area, where the major pollution source is the Westvaco paper mill, pollution levels range around 112 micrograms per cubic meter average for three stations. There has not been much change in recent years. The levels are considerably above the standards. In other parts of Area I, particulate levels are lower than the standards.

Area II - Central Maryland

Data are available from several locations in Frederick. The values are somewhat above the serious level standard of 75 micrograms per cubic meter in the central part of town and in close proximity to rock processing operations and below 65 micrograms per cubic meter in other parts of the city.

TABLE I

Ambient Air Quality Standards

	National		State	
	Primary	Secondary	Serious	More Adverse
Sulfur Oxides				
Annual Arithmetic Mean, ug/m^3	80	60	79	39
24-hour Maximum[b], ug/m^3	365	260	262	131
3-hour Maximum[b], ug/m^3		1,300		
1-hour Maximum[c], ug/m^3			525	262
5-minute Maximum[d], ug/m^3			1,310	655
Particulate Matter				
Suspended				
Annual Arithmetic Mean, ug/m^3	75[a]	60[a]	75	65
24-hour Maximum[b], ug/m^3	260	150	160	140
Settleable				
Annual Arithmetic Average, mg/cm^2/month			0.5	0.35
Monthly Maximum			1.0	0.7
Carbon Monoxide				
8-hour Maximum[b], mg/m^3	10	10	10	10
1-hour Maximum[b], mg/m^3	40	40	40	40
Hydrocarbons				
3-hour (6-9 AM) Maximum[b], ug/m^3	160	160	160	160
Nitrogen Dioxide				
Annual Arithmetic Mean, ug/m^3	100	100	100	100
Photochemical Oxidants				
1-hour Maximum[b], ug/m^3	160	160	160	160

a - annual geometric mean

b - not to be exceeded more than once per year

c - not to be exceeded more than once per month (8 times per month in Area III)

d - not to be exceeded more than twice per week (20 times per week in Area III)

Area III - Baltimore Metropolitan Area

Data are available for a long period of time at several locations in metropolitan Baltimore. Two stations in central downtown Baltimore indicate an average of about 120 micrograms per cubic meter for the period 1968-1971 as compared to an average of about 142 micrograms per cubic meter during 1964-1967. This indicates a decrease of about 22% in man-made pollution in central Baltimore for the two time periods. Current values are still considerably above the standards but at one location in central Baltimore (the National Air Sampling Network station), the lowest pollution level on record occurred in 1971.

Particulate pollution levels in and near industrialized areas range from 110 micrograms per cubic meter to about 130 micrograms per cubic meter, far in excess of the standards. At most stations, there are not enough years of data to indicate a trend but at two such stations, reductions for the most recent two to four years as compared to previous three or four year periods indicate reductions of 7 to 28%.

Pollution levels at suburban locations around Baltimore range from about 65 to 85 micrograms per cubic meter depending on the characteristics of human activity and the degree of urbanization to the immediate vicinity of the sampling site.

Pollution levels in Annapolis averaged 69 micrograms per cubic meter during 1964-67 and 62 micrograms per cubic meter in 1968-71, indicating a reduction of 24% in man-made pollution. Present levels are below air quality standards. In far suburban areas and rural areas of the region, pollution levels range from 50 to 65 micrograms per cubic meter and are in compliance with air quality standards.

Area IV - Washington Region

Particulate levels in Rockville have been measured for many years. Data for the most recent four years as compared to a previous four year period indicates that pollution levels have been increased but the recent data are considered unreliable since heavy construction activity occurred during two years of the four most recent years in the immediate vicinity of the sampling station. In 1971, particulate levels in Rockville averaged 68 micrograms per cubic meter, just over the standard of 65. At ten other locations in Montgomery County, particulate levels are below 65 micrograms per cubic meter except at two locations where levels were 66 and 68 micrograms per cubic meter.

In Prince George's County, there is no station where a long period of data are available. Measurements made at 16 locations in 1971 indicate that particulate levels in most places are less than 66 micrograms per cubic meter. At four locations, levels were at the 65-75 micrograms per cubic meter range and at two locations, levels were above 75 micrograms per cubic meter with one station in an industrialized park averaging 93 micrograms per cubic meter.

In general, particulate pollution in Montgomery and Prince George's Counties appears to be close to or within the air quality standards except in a few locations close to the source and intense public activity.

Area V - Southern Maryland

Particulate levels have been measured at two stations. Concentrations were below 65 micrograms per cubic meter annual average at both stations and, therefore, no problem seems to exist.

Area VI - Eastern Shore Region

Data are sparse from this lightly urbanized region but in general, those data available indicate little change in particulate levels over the past five years. Levels are generally 65 to 78 micrograms per cubic meter as measured in Elkton, Cambridge and Salisbury. As would be expected, particulate pollution is not elevated in this region.

2) Sulfur Dioxide

Introduction

Federal regulations indicate that sulfur dioxide should be measured by use of the West-Gaeke technique which is believed to be most nearly accurate and least subject to interference by other pollutants as compared to measurements made using the Davis electro-conductivity analyzer which has been used to collect most of the data in the past in Maryland. It is generally true that the Davis instrument indicates higher concentrations than the West-Gaeke technique for any particular parcel of air for which measurements are made. Thus, the following discussion will involve some complexities since many measurements were made using the Davis instrument and others were made with the West-Gaeke technique. The use of the Davis instrument is being phased out and is being replaced by either the West-Gaeke technique or an approved equivalent method, particularly the flame photometric technique.

Area I - Western Maryland

Measurements made in the Cumberland area using the West-Gaeke technique indicate that concentrations are below the standard of 39 micrograms per cubic meter annual average. However, data obtained using the Davis instrument indicate a possibility that the standard is being exceeded at some locations. In either event, pollution levels do not seem to be far above the standard, if at all.

In Hagerstown, data using the West-Gaeke technique indicate that sulfur dioxide levels are lower than called for by the standards. However, data obtained using the Davis instrument indicate that levels may be slightly in excess of the more adverse level. In any event, sulfur dioxide levels are not considered a serious problem.

In the Luke-Bloomington-Westernport area, sulfur dioxide levels are believed to be in excess of the standards at some locations because of emissions from the Westvaco paper mill but, at locations away from the influence of this single source, no problems are expected. Here again, data collected using the West-Gaeke technique indicate that sulfur dioxide levels are below the standards while at the same time, data collected using the Davis instrument indicate that levels are somewhat above the more adverse level standards.

Area II - Central Maryland

Data from four locations in Frederick indicate that sulfur dioxide concentrations are below the standard and no problem exists, as indicated by use of the West-Gaeke technique.

Area III - Baltimore Metropolitan Area

Data from the National Air Sampling Network collected from 1964 through 1971 indicate that significant reductions have occurred since imposition of the 1% sulfur limitation on fuel in July of 1970. Data from that station, collected using the West-Gaeke technique and data from 14 other locations in the metropolitan area using the West-Gaeke technique indicate that the annual average sulfur dioxide concentration is below the standard at all locations with concentrations ranging from 2 to 24 micrograms per cubic meter. Maximum 24 hourly values, however, occasionally exceed the more adverse level standard of 131 micrograms per cubic meter with values as high as 243 micrograms per cubic meter being recorded on rare occasions at a few locations. Based on these West-Gaeke measurements, it appears that the sulfur dioxide control program has been successful and that the air quality standards have been achieved. However, data obtained using the Davis instrument indicate that the standards are exceeded at some locations. The situation will be clarified as soon as data from stations using an approved technique accumulate.

Area IV - Washington Region

Data from 12 locations in Montgomery and Prince George's Counties obtained using the West-Gaeke technique in 1971 indicate that the annual average sulfur dioxide concentration is lower than the air quality standard of 39 micrograms per cubic meter. However, occasional maximum days do occur which exceed the more adverse level standard of 131 micrograms per cubic meter. No values are exceeded of the serious level standard for 24 hours of 262 micrograms per cubic meter were recorded in 1971. It, thus, appears that sulfur dioxide levels in this region are meeting the standards.

Data are made available to us by the Potomac Electric Power Company on sulfur dioxide levels in the vicinity of the Chalk Point and Dickerson electric generating stations. These data are obtained using the electro-conductivity method. They indicate that air quality is very close to the more adverse level standards with most data indicating that sulfur dioxide levels are lower than the standards, and that only on rare occasions do elevated levels in excess of the standards occur.

Area V - Southern Maryland

No measurements have been made of sulfur dioxide in this region except those made by Potomac Electric Power Company in the vicinity of the Morgantown generating station using the electro-conductivity technique. These data indicate that air quality is close to the more adverse level standard with most concentrations being below the standard and only on rare occasions are elevated levels above the standard observed.

Area VI - Eastern Shore Region

No measurements have been made of sulfur dioxide in this region and no problems are expected except that there is some possibility that elevated levels might occur on infrequent occasions in the immediate vicinity of the Delmarva Power and Light Company plant in Vienna, Maryland.

3) Photochemical Oxidants

The Federal regulations require that photochemical oxidants be measured by use of the potassium iodide (KI) method or by some approved equivalent method. Only very limited data are available from measurements made using such an approved method to relate Maryland's air concentrations to the Federal standard of 160 micrograms per cubic meter maximum one hour average. A considerable body of data are available for the metropolitan Baltimore area which were obtained using the phenolpthalein method. These data were compared to those obtained during the past summer using the AIRMON stations. The AIRMON stations employ the chemiluminescence method, which is an approved equivalent of the potassium iodide method. The comparison indicated that the phenolpthalein method measurements yield lower concentrations than the chemiluminescence method. In any event, data available using the potassium iodide method and the chemiluminescence method indicate that maximum hourly average concentrations in both the Baltimore and Washington regions are about 400 micrograms per cubic meter as compared to the standard of 160. Thus, it is clear that we have a severe oxidant problem in these two metropolitan areas.

Almost no data are available on photochemical oxidant concentrations in parts of the State other than the Washington and Baltimore metropolitan areas but high concentrations are not expected because of the relatively small population concentrations existing in these other areas.

4) Carbon Monoxide

Measurements have been made of carbon monoxide in the metropolitan Baltimore area for some time by local governmental agencies. However, the accuracy of these data is subject to question. We would expect, however, that carbon monoxide concentrations in the Baltimore and Washington regions would be similar to those which have been observed in other major urban centers. The Federal government has made measurements of carbon monoxide at eight continuous air monitoring programs (CAMP) stations for many years in Chicago, Cincinnati, Denver, Philadelphia, St. Louis, San Francisco, Los Angeles and Washington, D.C. Data for the period 1962 through 1967 indicate that maximum hourly concentrations on the average for five cities which are similar to Baltimore and Washington are 45 milligrams per cubic meter (average of Cincinnati, Denver, St. Louis, San Francisco, and Washington, D.C.). Maximum eight hourly average values in these same five cities average 27 milligrams per cubic meter as compared to the standard of 10 milligrams per cubic meter. Reductions in carbon monoxide emissions from motor vehicles which have occurred since the advent of "cleaner" cars in 1968 have probably reduced these concentrations by about 15%, when considering deterioration of emission control systems, increase in vehicle use and other community factors. In any event, it is clear that our carbon monoxide levels are far in excess of the standards.

5) Nitrogen Dioxide

The air quality situation nationally with respect to nitrogen dioxide was put into a state of turmoil when the Federal government, in June of 1972, published a notice that nitrogen dioxide levels as indicated by certain methods of measurement were considered inaccurate and further that the Federal government was evaluating the accuracy of several methods of measurements of nitrogen dioxide. The investigations being made by EPA were not completed by the end of 1972 as originally planned. In addition to continued study of nitrogen dioxide measurement techniques, the ambient air standards are also being reviewed. For example, the 90% reduction of nitrogen oxides required under the Clean Air Act for 1976 automobiles is no longer justified according to the EPA, and will be discontinued until further studies are completed.

Thus, nobody at this time has a clean picture of how air pollution by nitrogen dioxide stands. We do have some data for the Baltimore and Washington metropolitan regions. One group of data would indicate that concentrations are lower than the 100 micrograms per cubic meter annual average standard but one other limited body of data developed in the summer of 1971 by the Federal government indicates that our levels may be substantially above the standards. Thus, the picture concerning nitrogen dioxide in the metropolitan Baltimore and Washington regions is in doubt at this time.

Some data are available on nitrogen dioxide concentrations in parts of Maryland other than the Baltimore and Washington regions. Even in spite of all of the uncertainties concerning techniques of measurements, it appears that we have no nitrogen dioxide problems outside of the Washington and Baltimore regions.

6) Soiling Index

One method of measurement of particulate matter in the atmosphere involves the filtration of particulate matter from the atmosphere by passing it through filter paper and then making a comparison based on the change in light transmission through a piece of filter paper which has been used for sampling as compared to a piece of clean filter paper. The value obtained is referred to as the "soiling index" and is expressed in coh's per thousand linear feet of air. Annual average values below 0.5 coh's are generally considered to indicate a satisfactorily low level of small-sized black particles in the air. Average values in years gone by in many Maryland communities were at or above 1.0 coh's. In recent years, average values are almost universally below 0.5 coh's throughout the State. It thus appears that the presence of small-sized black particles in the atmosphere has been substantially reduced.

c. PROSPECTS FOR ACHIEVEMENT OF AMBIENT AIR QUALITY STANDARDS IN MARYLAND

1) Particulate Matter

General

Particulate pollution levels in urban areas are made up of a combination of naturally occurring pollutants (pollen, spores, sea salt, volcanic ash, wind blown surface dust, etc.) and particulate matter generated by man's activities. The naturally occurring particulate level in rural areas is about 40 $\mu g/m^3$. In urban areas, there is also a sort of "base" of particulate in the atmosphere which is not amenable to control. This "base" is made up of things like dust stirred up on streets by automobiles moving and the wind; cooking of food; tobacco smoke; particles of tires and brake linings; wind-blown dust from athletic fields; parking lots, and the like; dust from construction and demolition activities; etc. The magnitude of this base seems to be at a level somewhere around 15 $\mu g/m^3$. Thus, when added to natural background, the minimum suspended particulate level that one would expect in a very clean urban center would be somewhere around 55 $\mu g/m^3$. This leaves only 5 or 10 $\mu g/m^3$ which may be around for contributions by all other sources of particulate matter. It also indicates that in many urban centers, it will not be possible under present circumstances to achieve ambient air quality standards.

Area I - Western Maryland

Particulate levels in Cumberland now run around 110 $\mu g/m^3$. Emission control has moved well along toward completion but some additional reductions in emissions from industrial sources is programmed and some additional reduction can be expected as the remaining small coal-fired space heating plants are replaced by gas and oil-fired plants. Particulate levels might go down to as low as 75 $\mu g/m^3$ by 1975. Even this level, much less than the lower more adverse level standard achievement would be in doubt at least in part because of the poor atmospheric ventilation in this area caused by the rugged mountainous terrain.

In the Luke-Bloomington-Westernport area, particulate levels now average around 112 $\mu g/m^3$. Further substantial reductions can be expected as the Westvaco paper mill reduces emissions from the black liquor recovery furnace and from coal-fired boilers. It may be that the standard of 75 $\mu g/m^3$ will be achieved.

In Hagerstown, present particulate levels average about 77 $\mu g/m^3$. Further reductions can be expected as the numerous small coal-fired heating plants are replaced by oil and gas-fired plants and as a few industrial abatement activities now in progress are completed. Achievement of a 65 $\mu g/m^3$ level would be doubtful since atmospheric ventilation in this community is restricted by the valley location of the community.

Area II - Central Maryland

Particulate levels in Frederick range from 57-77 $\mu g/m^3$ at various locations in the community. The prospects for achieving the 65 $\mu g/m^3$ standard are good.

Area III - Baltimore Metropolitan Area

While the trend of particulate levels in the central part of Baltimore is downward, it seems unlikely that the 65 $\mu g/m^3$ standard will be achieved. Further reductions from present levels in the 90-135 $\mu g/m^3$ range down close to 75 $\mu g/m^3$ can be expected as the on-going programs for elimination of small incinerators, abatement of industrial emissions, installation of dust collectors on residual oil boilers and other abatement actions are completed. Some reductions may also come about by virtue of reduction in sulfur oxide emissions which contribute to the formation of particulate sulfate compounds in the atmosphere, and by virtue of reduced emissions of hydrocarbons from motor vehicles and stationary sources which may reduce the formation of photochemical aerosals.

Particulate levels in the Annapolis area and in suburban Baltimore and rural areas appear to be at levels below the 65 $\mu g/m^3$.

Area IV - Washington Area

Particulate levels now at various locations are in the 65-75 $\mu g/m^3$ range with the exception of a very few locations with somewhat higher levels. Some additional reductions can be expected as the incinerator phase-out program is completed; dust collectors are installed on residual oil boilers; a few industrial source abatement programs are completed and probable reductions associated with lower sulfur oxide and hydrocarbon emissions (as described for Area III) occur. It seems likely that air quality will come close to achievement of the 65 $\mu g/m^3$ standard with the exception of perhaps a few locations where population density and public activities are greatest.

Area V - Southern Maryland

Suspended particulate levels in this region at this time are at or below the air quality standard of 65 $\mu g/m^3$.

Area VI - Eastern Shore Region

Particulate levels in the major communities on the Eastern Shore are generally in the 65-75 $\mu g/m^3$ range. In Cambridge, levels are somewhat about 75 $\mu g/m^3$. In this community, completion of on-going industrial abatement work should bring about some additional reduction in pollution levels. In general, particulate levels in this region should approach compliance with the standard of 65 $\mu g/m^3$.

2) Sulfur Dioxide

General

Much of the data from past years in Maryland were obtained using the electro-conductivity technique. Thus, interpretation of the present situation and prospects for the future are somewhat shakey. However, in reviewing the data, considerable weight has been placed on data obtained in more recent times using the West-Gaeke technique which is the reference method for comparing air quality to the standards. Also, the flame photometric technique being used in the State's AIRMON system is an approved equivalent method for relating air quality to the standards.

Area I - Western Maryland

The preponderance of evidence indicates that the air quality standards are achieved at this time. Further information as to the exact situation will be available shortly from on-going measurements. There may be a few "hot spots" in the vicinity of the Westvaco paper mill. Levels at such locations will be reduced in the future when the Westvaco boilers are fitted with stack gas desulfurization equipment or changes in fuel sulfur content are made. Further reductions can also be expected in Cumberland and Hagerstown as the numerous small coal-fired space heating plants are phased-out by replacement with oil and gas-fired plants.

Area II - Central Maryland

Presently available data indicate that air quality standards have been achieved in this region.

Area III - Baltimore Metropolitan Area

Available data using approved techniques indicate that the annual average standards have been achieved but maximum daily average concentrations exceed the standard for 24 hours on a few occasions at a few stations. Further reductions in sulfur oxide levels can be expected since Baltimore Gas and Electric Company has completed conversion of its plants from coal-firing to low sulfur oil-firing. Additional reductions will occur because of conversion of quite a few residual oil burning plants to distillate oil and gas burning in connection with requirements that dust collectors be installed on residual oil-fired plants. Additionally, some four thousand small domestic coal-fired plants are gradually being replaced by gas and distillate oil-fired heating plants. Therefore, we would expect that the sulfur dioxide standards will be achieved. Some possible problems could arise in the vicinity of the Baltimore Gas and Electric Company Wagner Station if an additional plant is built on a site adjacent to it (the proposed Brandon Shores Station).

Area IV - Washington Region

Available data using approved techniques indicate that the annual average standard has been achieved but the 24 hourly average standard is exceeded on a few days each year at a few locations. Further reduction in sulfur dioxide levels can be expected since a large number of residual oil-fired heating plants are being converted to distillate oil-firing rather than installing a dust collector and continue to burn residual oil.

There is some possibility that sulfur dioxide levels will exceed air quality standards in the vicinity of the Chalk Point and Dickerson generating stations of PEPCO when the contemplated major expansions occur. The situation will depend upon whether or not presently being developed stack gas desulfurization equipment becomes commercially usable, and on the sulfur content of fuel to be burned at these two stations.

It appears that air quality standards will be achieved in this region.

Area V - Southern Maryland

No sulfur dioxide concentrations in excess of the standards exist at this time and none are expected.

Area VI - Eastern Shore Region

There is no indication that sulfur dioxide standards are exceeded in this region at this time. There is some possibility, not verified by measurement as yet, that the standards may be exceeded in the vicinity of the Delmarva Power and Light Company Plant at Vienna.

3) Photochemical Oxidants

Area I - Western Maryland
Area II - Central Maryland
Area V - Southern Maryland
Area VI - Eastern Shore Region

There is no data to indicate that the air quality standards for photochemical oxidants are exceeded in these areas, and we would not expect that the standard is exceeded. However, some limited data from rural areas in Garrett County indicate that the oxidant standard is exceeded at times. The reasons for elevated concentrations in such rural areas are unclear. The high concentrations may be due to natural photochemical reactions involving hydrocarbons and nitrogen oxides arising from biological processes with some enhancement of the reactions because of nitrogen oxides arising from a power plant located in Mount Storm, West Virginia.

Area III - Baltimore Metropolitan Area
Area IV - Washington Region

The present levels of photochemical oxidants in these two regions are about 400μ g/m^3, and are in excess of the standard 160μ g/m^3. Making estimates of what will happen to photochemical oxidant concentrations in the future, as the Federal new motor vehicle pollution control program causes its impacts, and as reductions in emissions of hydrocarbons and nitrogen oxides from stationary sources are put into effect, is fraught with technical complexities and unknowns. The Federal government has suggested techniques for estimating expected reductions in photochemical oxidants. Their utilization indicate that a 58% reduction in hydrocarbon emissions is needed in Baltimore and Washington to achieve the standard of 160 μg/m^3 of photochemical oxidants. We expect to achieve a 5-10% reduction in emissions of hydrocarbons from stationary sources. Stationary sources represent about 25% of the total hydrocarbon inventory. Reduction in hydrocarbons from motor vehicles are estimated to be 48% in 1975 as compared to 1967. A 6% reduction is expected by 1977, in both cases giving consideration to the effectiveness of new motor vehicle hydrocarbon reduction actions, growth in vehicle miles travelled, deterioration of emission control systems, and other factors. Our best judgment is that photochemical oxidant levels will not be reduced to the standard level or below unless substantial reductions (on the order of 20%) are made in motor vehicle travel through substitution of mass transit for personal vehicle travel. It may also be necessary and possible to further reduce evaporative losses of gasoline which now occur when filling the gasoline tanks of motor vehicles; when filling service station tanks from tank trucks; and miscellaneous solvent evaporations.

It should be noted that in a number of rural areas naturally occurring photochemical oxidant concentrations are 100 μg/m^3 which leaves only 60 μg/m^3 of photochemical oxidants associated with man's activities that can be added to total pollution levels in urban areas and still achieve the standard.

4) Carbon Monoxide

Evaluation indicates that the impacts of the Federal new motor vehicle pollution control programs will enable achievement of the carbon monoxide standard by 1978 or 1979. Some reductions in existing levels will also be brought by modest reductions in emissions from a few industrial sources. The Federal law requires, however, that the standard be achieved by 1975 unless a two-year extension is granted by the Federal government. Such two-year extensions have been granted by the Federal government in the cases of the Baltimore and Washington Regions. However, it still seems that it will be necessary to reduce motor vehicle travel in order to achieve the carbon monoxide standard by 1977.

Except in Baltimore and Washington regions where motor vehicle density is highest, carbon monoxide standards are probably being achieved already in most areas of the State. However, although no data are available, it is probable that at some street intersections in cities such as Cumberland, Hagerstown, and Frederick during times of high motor vehicle activity, the carbon monoxide standards are exceeded. However, the Federal new motor vehicle carbon monoxide control programs should eliminate any such problems if they do, in fact, exist.

5) Nitrogen Dioxide

As indicated in the discussion on "The Status of Pollution Levels in Maryland" presented earlier, the air quality situation with respect to nitrogen dioxide is in a state of turmoil and uncertainty. Therefore, it is not possible at this time to indicate whether the air quality standards are being achieved and if not, what the prospects would be for the future.

d. EXPENDITURES FOR POLLUTION CONTROL

1) Major Source Abatement Activities

Over the past four years, Maryland's Bureau of Air Quality Control has negotiated plans for compliance with about 145 establishments providing for bringing their pollutant emissions into compliance with the various regulations. Total money spent so far is estimated to be about $71,550,000. Monies committed to be spent from now through 1975 or so are estimated at $58,000,000 if the Potomac Electric Power Company converts the Chalk Point and Dickerson power stations to use of oil instead of installing stack gas desulfurization equipment and continuing to burn coal. If PEPCO elects to install stack gas desulfurization equipment on the Chalk Point, Dickerson and Morgantown plants, the total expenditure to be made would be about $148,000,000. Expenditures by these several categories of industry are shown in the following table:

	Number of Companies	Spent 1968-1972	Committed for 1972-1975
		Thousands of Dollars	
Power companies	5	32,400	(a) 96,000
Cement manufacture	3	3,700	(b) 8,000
General manufacturing	14	2,700	
Metallurgical industries	16	14,200	37,800
Chemical process industries	20	15,600	11,600
Rock and stone industries	14	800	900
Asphalt batching (plants)	68	1,800	800
Others	15	350	250
Totals	145	$71,550	(a) $147,250 (PEPCO desulfurize) (b) $58,000 (PEPCO converts Chalk Point and Dickerson to oil)

Outside of the power companies, the largest expenditures will be made by Bethlehem Steel Company. The company has spent an estimated $7,600,000 from 1968 through today. An additional expenditure of about $35,500,000 is contemplated with the largest items to be undertaken being construction of a $20,000,000 facility for desulfurization of coke oven gases and about $10,000,000 for dust collectors on a new sintering plant which is also being built. These expenditures by Bethlehem Steel are large. Company expenditures made during the period 1948-1971 amounted to $85,000,000 for installation and operation of air pollution control equipment. During that same period, gross revenues were about $19,000,000,000. Thus, expenditures for air pollution control amounted to about 0.4% of gross revenues. It is estimated that these expenditures resulted in an added $1.40 per ton to the average selling price of various steel products of something like $180 per ton.

The next most significant expenditure is probably related to increased fuel costs associated with conversion of power plants from coal-firing to low sulfur oil-firing, conversion of other coal-firing plants to low sulfur residual oil-firing plants, and converting from 2.2% residual oil to 1% residual oil. It was estimated that the increased fuel costs for the large plants which burned residual oil both before and after the low sulfur requirements would be about $5,500,000 per year. Increased fuel costs incurred by electric generating companies would probably be in the range of $11,000,000 a year, and also in the range of something like a 10 to 15% increase in fuel costs for electric generating uses.

A very significant expenditure for control of pollution from motor vehicles is expected. The 1972 models are said to cost about $35 more per car because of air pollution requirements as compared to 1967 models. Estimates are that the 1973-74 models will cost $82 each more than the 1967 models; the 1975 models would cost $246 more; and the 1976 models would cost $350 more. Thus, at a $35 per car increase and a sale of about 200,000 new cars per year in Maryland, an expenditure of $7,000,000 per year is involved. This represents perhaps 1% or 2% of the total value of the new cars in 1972. In 1976, however, at an increased cost of $350 per car, the expenditure for pollution control equipment would be in the range of $70,000,000 per year for the State of Maryland and would represent perhaps more than 10% of the total value of the new vehicles sold.

It is also expected that lead-free gasoline will be needed for 1975 and later model cars. It is being said that this lead-free gasoline will cost 2¢ per gallon more than the presently used gasoline. If this is true, the increased gasoline cost for residents of Maryland could be in the $25,000,000 to $30,000,000 per year range.

2) Other Source Abatement Activities

Elimination of small on-site incinerators has been required. There were some 1,500 of these in the State in the Baltimore and Washington regions where they are being phased out. It is estimated that about 320 of these will be replaced with compactors at a total cost of about $2,000,000. The remaining units will employ haul-away service and incur no increase in cost.

Maryland regulation requires the installation of dust collectors on residual oil burning plants. There are about 204,000 of these. It is expected that the small ones convert to use of distillate oil and thus, will incur about a 10% increase on their fuel costs. Some 200 or so units may be fitted with dust collectors at a cost of something like $6,000,000 totally.

Regulations prohibited the open burning of auto bodies in preparation of sending them to steel mills for recycling. In order to properly prepare the bodies, it was necessary to build shredders. Two of these were built at a total cost of about $1,500,000.

State-owned buildings were brought into compliance with the regulations by updating fuel burning equipment and refuse handling equipment. This involved an expenditure and commitment of about $2,000,000. About 200,000 additional dollars need to be committed to complete the job.

The many Federally-owned buildings are being brought into compliance by upgrading fuel burning equipment, and refuse burning equipment is being upgraded or phased out. About $2,800,000 has been spent or committed to date and about $1,400,000 is yet to be committed or spent.

A recent regulation would require the control of hydrocarbons from large installations such as can making companies, large paint spraying operations, certain kinds of printing operations and others. About 32 establishments are involved. It is estimated that about $2,000,000 in capital expenditures will need to be made over the next two or three years to bring these facilities into compliance.

Another Maryland regulation requires that gasoline storage tanks be fitted with floating roofs or otherwise be arranged to prevent the loss of hydrocarbons during filling and during temperature changes. There are a total of 84 tanks involved of which about 23 are needed to be fitted with floating roofs. It is estimated that an expenditure in the range of 300 to 400 thousand dollars will be required to accomplish this job. However, prevention of loss of gasoline vapors to the atmopshere will result in a payout on the investment in about four years.

Maryland regulations prohibit the burning of refuse in open fires. There are currently no estimates for the costs involved in hauling this refuse to a central disposal facility and disposing of it there. But a rough estimate would indicate that additional refuse handling expenditures in the range of $5,000,000 have been involved. Further, the open burning of leaves has been phasing out. A rough guess might be that it is now costing people in the Baltimore and Washington regions about $3,000,000 a year for leaf collection services which they did not spend before. The City of Baltimore is undertaking substantial expenditures to clean up their solid waste disposal facilities. The Pulaski Highway incinerator is being improved by the addition of two new furnaces which will be equipped with high efficient dust collectors. The total cost of this project is in the neighborhood of $6,000,000. In addition, the City, Maryland Environmental Service, and EPA will erect a thousand tons per day pyrolysis plant which will cost in the neighborhood of $15,000,000.

The practice of burning land clearing wastes have been pretty much phased out in the metropolitan areas. This has increased the cost of land clearing by around $400 per acre. Air pollution control has been one reason for substituting sanitary landfills for open burning dumps. The cost in doing this has been significant but there is no way of estimating what part of the expenditure should be charged to air pollution control purposes.

There are a variety of other relative lesser expenditures which have been made and which are yet to be made to bring facilities into compliance with our air pollution control regulations. It is doubtful that the aggregate of these amounts to any more than two or three million dollars.

On balance, all of these air pollution abatement expenditures seem to be able to be accommodated in the socioeconomic plans of Maryland.

IIB. SOLID WASTES QUALITY

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1. Introduction

Although there has been a growing concern with problems of solid waste management over the last several years, it is only recently that the mountains of garbage and refuse which Maryland citizens generate every year, have been systematically and vigorously attacked.

Since the passage of the Federal Solid Waste Disposal Act in 1965, and laws enacted in 1970 by the Maryland General Assembly and the U.S. Congress pertaining to more effective solid waste management, Maryland has been improving its solid waste services.

Yet many challenges remain -- in increasing volumes of waste generated; in increasing hazards of wastes; in decreasing waste storage facilities; and in increasing costs of collection and disposal to name a few.

This preliminary audit of solid wastes quality was accomplished by the Committee to attempt to highlight some important problems, which if effectively addressed now might prevent larger problems in the future.

2. Findings

a. Shift from open burning dumps to sanitary landfills and incinerators for solid wastes disposal has occurred in Maryland thus improving the conditions for better health and safety for its citizens.

b. Future plans show a further shift in disposal techniques to major volume reduction centers with reclamation and recycling and improved incineration in urban areas and this is the proper direction for accommodating the ever increasing volumes of solid wastes.

c. The approximately 4 million tons per year of solid wastes generated in Maryland, are collected and disposed of at costs of about $15M annually. These volumes and costs are expected to rise to almost 5 million tons and $20M annually by 1975.

d. Increasing disposal costs will be somewhat ameliorated by payback from recycling energy and reclamation of useful materials, but disposal costs represent only about 20% of total solid waste management costs, and similar savings in collection, removal and storage are not as obvious.

The combination of the use of advanced disposal technology (e.g. pyrolysis and recycling) to supplement current techniques, could significantly reduce overall costs and raise volume handling capacities in the late 1970's and early 1980's.

e. A significant final disposal volume reduction is anticipated through the use of improved incineration and pyrolysis in the urban areas. But this will be offset by increasing volumes of sewage solids requiring disposal, because of tightened water standards.

f. Increasing amounts of hazardous wastes, whether from toxic chemicals, drugs, infectious materials, natural products, flammables, mechanical hazards, or radioactive materials may become serious problems in 1975 and beyond.

There are no good data yet in Maryland on sources and volumes of these hazardous wastes, and no uniform systems for control and disposal of them (except for radioactive wastes).

3. <u>Recommendations</u>

a. Collection and disposal of solid wastes by Regions, as developed by the State Department of Health and Mental Hygiene should be fostered as a more practical and economic approach, than the smaller political jurisdictional systems now in effect.

b. Legislation should be introduced to improve permit requirements; and to promote recycling of incinerator and other solid wastes.

c. Maximum use should be made of the Environmental Protection Agency's studies of hazardous wastes. However, State agencies should survey Maryland's specific current and expected sources of hazardous wastes, current and proposed disposal methods, and relative hazards.

d. The current studies of sewage waste generation and disposal should be expanded to include the impact of tighter water quality standards.

4. <u>Discussion</u>

Discussions on the Solid Waste problem in Maryland were held with:

William Harrington, Associate - Whitman Requardt and Associates: Chairman of the Solid Waste Committee of the American Society of Mechanical Engineers.

Thomas McKewen, Director, Maryland Environmental Services.

Robert Dietrich, Chief, Technical Division of the Department of Public Works, Baltimore City.

William H. Shields, Chief, Solid Waste Survey, Maryland Environmental Services.

Raymond J. Karpen, Maryland State Health Department of Health and Mental Hygiene.

A number of reports and studies developed by others have been reviewed by the subcommittee. Some of these are:

"Solid Waste Management Plan for Maryland," DHMH 803-750-971, dated 1971 by the Division of Solid Wastes of the Maryland State Department of Health and Mental Hygiene.

"Baltimore About Garbage," 1972, a study by the Commission on Governmental Efficiency and Economy, Inc.

"Collection and Disposal of Solid Wastes," August 1, 1966 by the Maryland State Department of Health.

"Preliminary Plan Tentative Feasible Solid Wastes Systems, Baltimore Region," February 1972, by Bivens and Associates, Inc. and Engineering-Science, Inc.

Appendix J of "City of Baltimore Solid Waste Master Plans," May 1972 by City of Baltimore, Department of Public Works.

Recently, the Maryland State Health Department has instituted a series of seminars designed to instruct and to stimulate interest through the State in solving solid waste problems. They have also proposed dividing the State into regions as is shown on the attached map, Figure 1. Article 43 of the Health Laws of Maryland provides for solid waste facilities to be jointly financed under a joint authority of the State Department of Health and any County or Baltimore City.

The Division of Solid Wastes of the State Department of Health and Mental Hygiene has prepared "Instructions for the Preparation of County Solid Wastes Management Plans" and is engaged in assembling these plans from each of the proposed regions.

Data gathered as a result of these conferences have been put into graph form and is attached hereto. Figure 2 shows predicted population in Maryland; Fig. 3 shows the rate at which solid wastes are produced or will be produced in pounds per capita per day. By multiplying the population by the predicted production rate, the total daily volume of

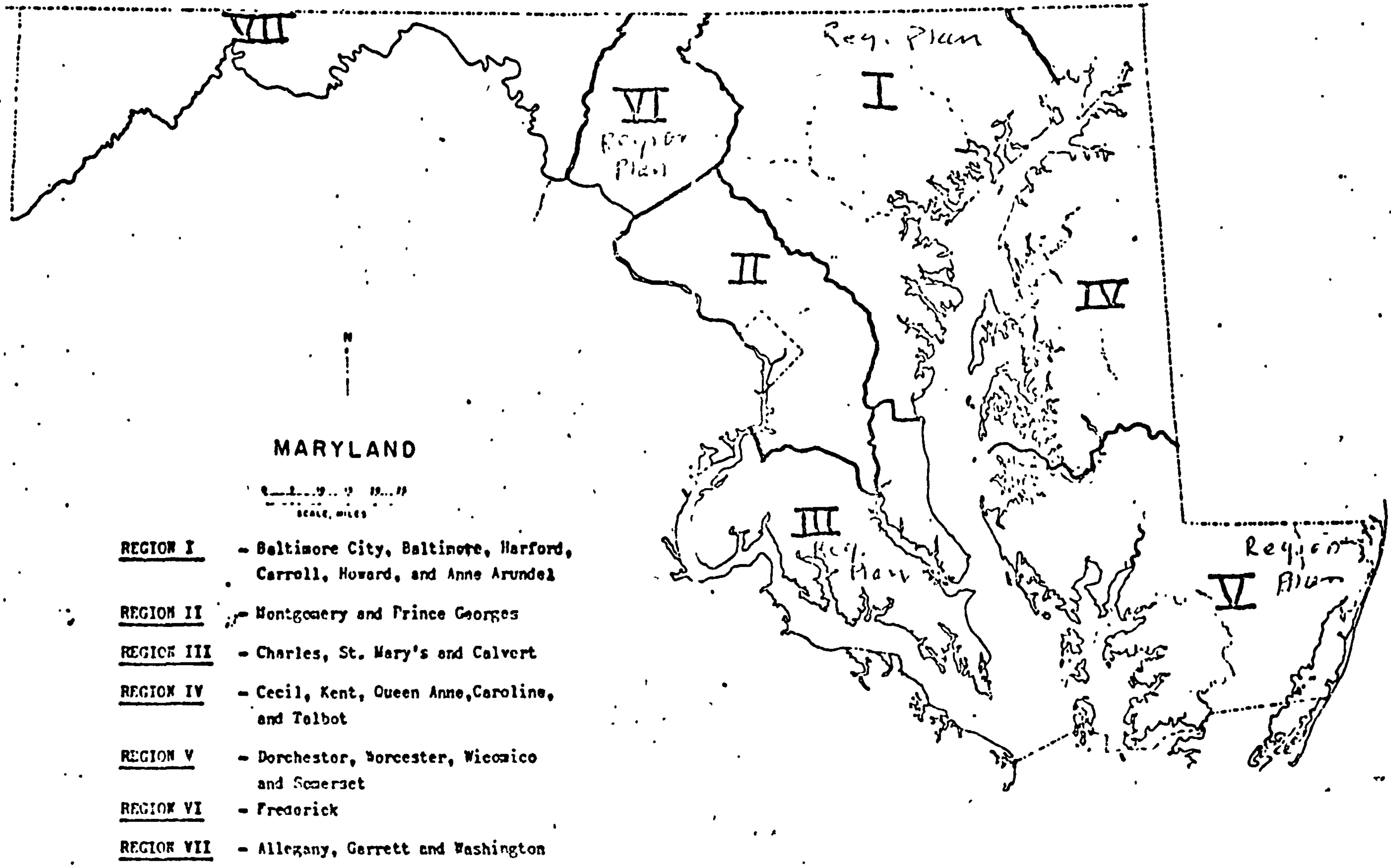

Fig. 1 - PROPOSED REGIONS OF THE MARYLAND ENVIRONMENTAL SERVICE (7/1/71)

NOTE: THE REGIONS PROPOSED HEREIN ARE PURSUANT TO ARTICLE 33B SECTION 5 OF THE ANNOTATED CODE OF MARYLAND AND COMPREHEND THE EXISTING REGIONAL ORGANIZATION CURRENTLY IN USE BY THE DEPARTMENT OF STATE PLANNING AS WELL AS SENATORIAL DISTRICTS, JUDICIAL DISTRICTS AND EXISTING INSTITUTIONAL/ REGIONAL ARRANGEMENTS.

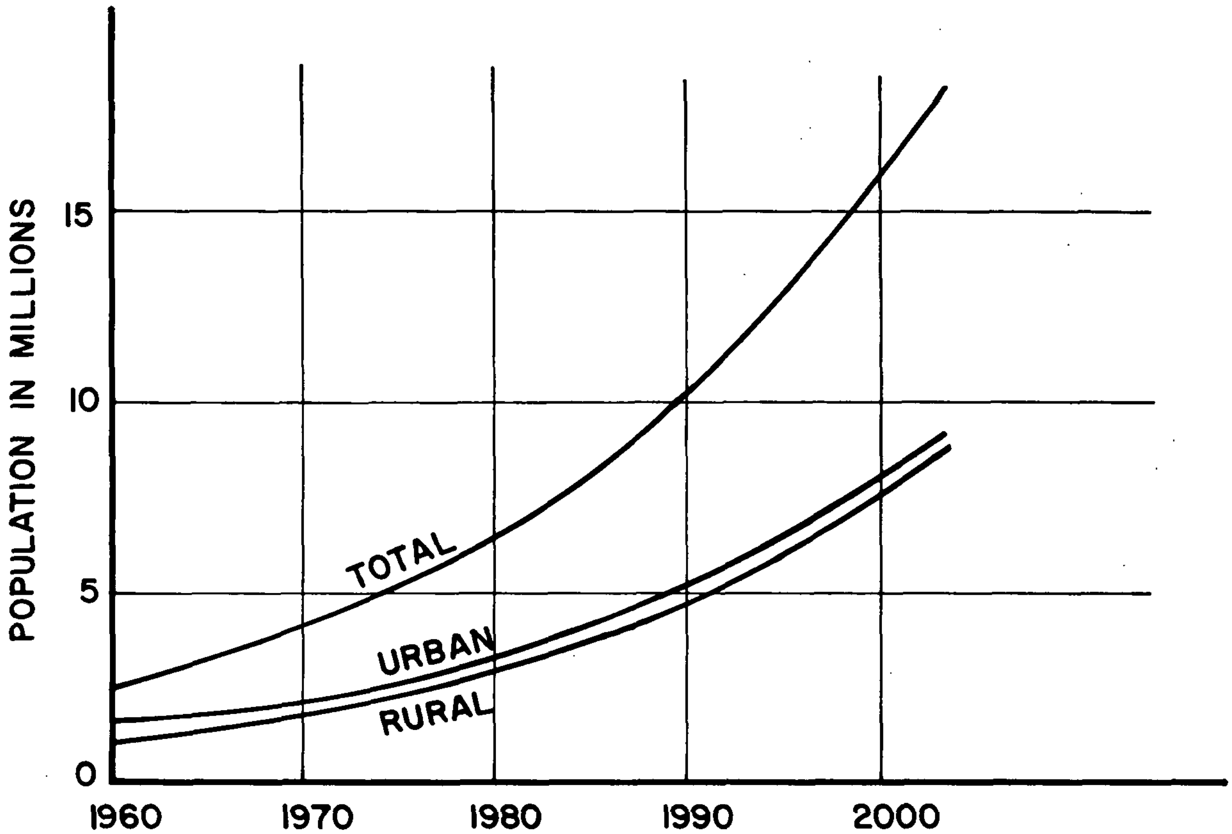

Figure 2. **POPULATION IN MARYLAND**

(FROM DATA SUPPLIED BY CHARLES M. KENEALY)

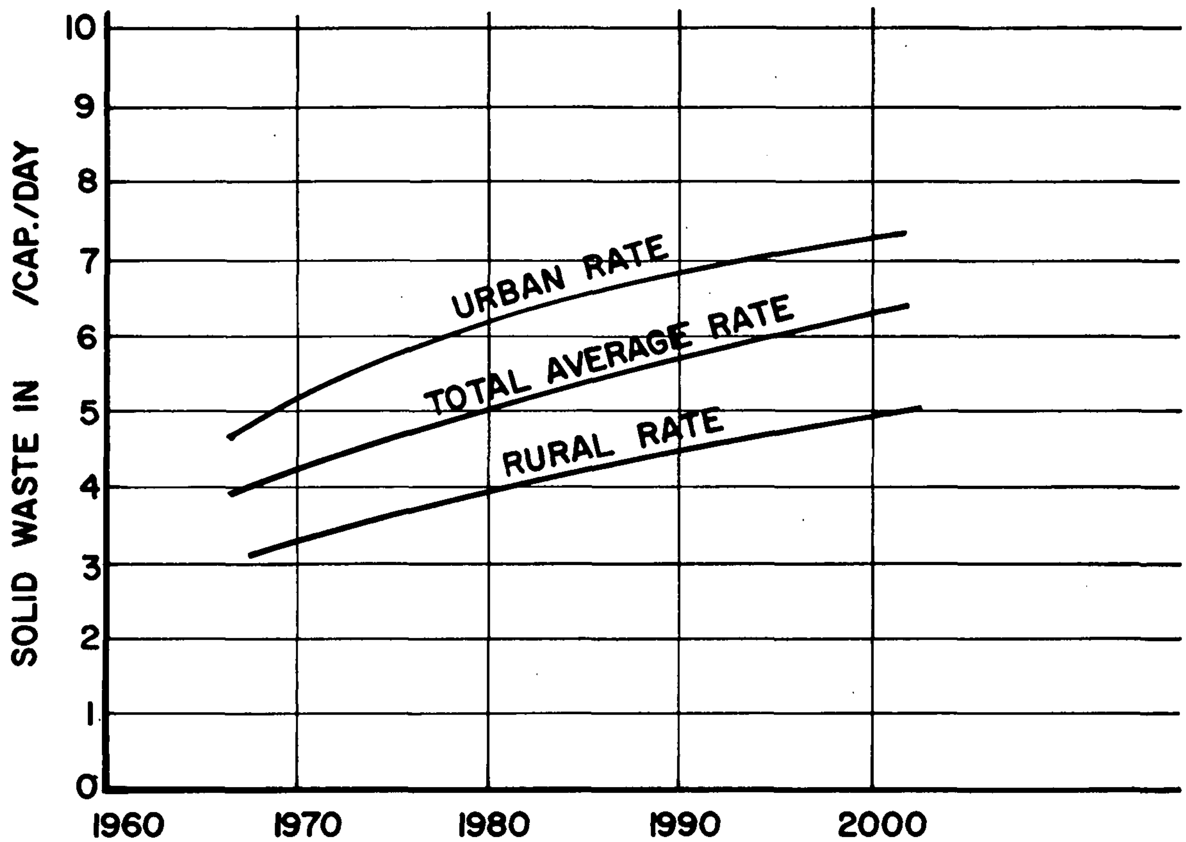

Figure 3. **RATE OF PRODUCTION OF SOLID WASTE IN MARYLAND**

solid wastes may be predicted. These figures have been reduced to millions of tons per year and are shown on Fig. 4. It can be seen from the latter that the volume of solid wastes produced in rural areas is less than produced in urban areas. This is due to the fact that both the population and rate of waste production is less in rural than in the urban areas.

Figure 5 shows the estimated cost of disposing of solid wastes in Maryland. Curve A applies the present day volumes and costs to predicted volume indicated in Figure 4, with no changes in technology. Curve B assumes that future urban waste is disposed of entirely by incineration while future rural waste is disposed of entirely in landfills. Curve C assumes that future urban waste is disposed of entirely by pyrolysis while future rural waste is disposed of entirely in landfills, and Curve D shows the effects of recycling of materials and energy when applied to the pyrolysis operations in the urban areas while still using sanitary landfills in the rural areas. Since the population figures for Curve A, B, C and D are all the same, the cost differentials are entirely due to the differences in cost of the various methods of disposal. The curves are based on 1970 costs and do not consider the effect of inflation, nor do they take into account the costs of land, initial capital costs or the cost of solid waste collection.

It is readily apparent that recycling has a significant effect on the cost of disposing of solid wastes. Maryland will be leading the way in this approach when Baltimore's 1000 tons per day pyrolysis plant goes into operation. This plant is expected to process solid wastes at a cost of \$7.33 per ton, as compared to about \$9.00 per ton by incineration. In addition, this plant is expected to produce low pressure steam which will be sold to the Baltimore Gas and Electric Company at a savings in cost of \$3.80 per ton. An additional \$0.87 per ton may be saved by the reclamation of ferrous metals and glass residue, resulting in a net cost of \$2.66 per ton.

The pyrolysis plant is expected to contribute little or no particulate matter to the air and is expected to meet the Air Quality Standards of Maryland. It will make an additional contribution to clean air in that it will result in eliminating the burning of the fossil fuel that would otherwise be necessary to burn the solid wastes and that is necessary to generate the steam.

When the pyrolysis plant is in operation, it will dispose of 365,000 tons per year while Baltimore Incinerator No. 4 will process 219,000 tons per year. This is a total of 584,000 tons per year. Since about half of Maryland's urban population is in Baltimore, about half of the total solid wastes developed in the urban areas will be in Baltimore. Figure 4 indicates that the total solid waste from urban areas will be about 2.6 million tons per year by 1975. Half of this is 1.3 million. This means that by 1975, if the Reedbird Avenue incinerator is shut down completely there will be a total of 716,000 tons to be disposed of in landfills or by

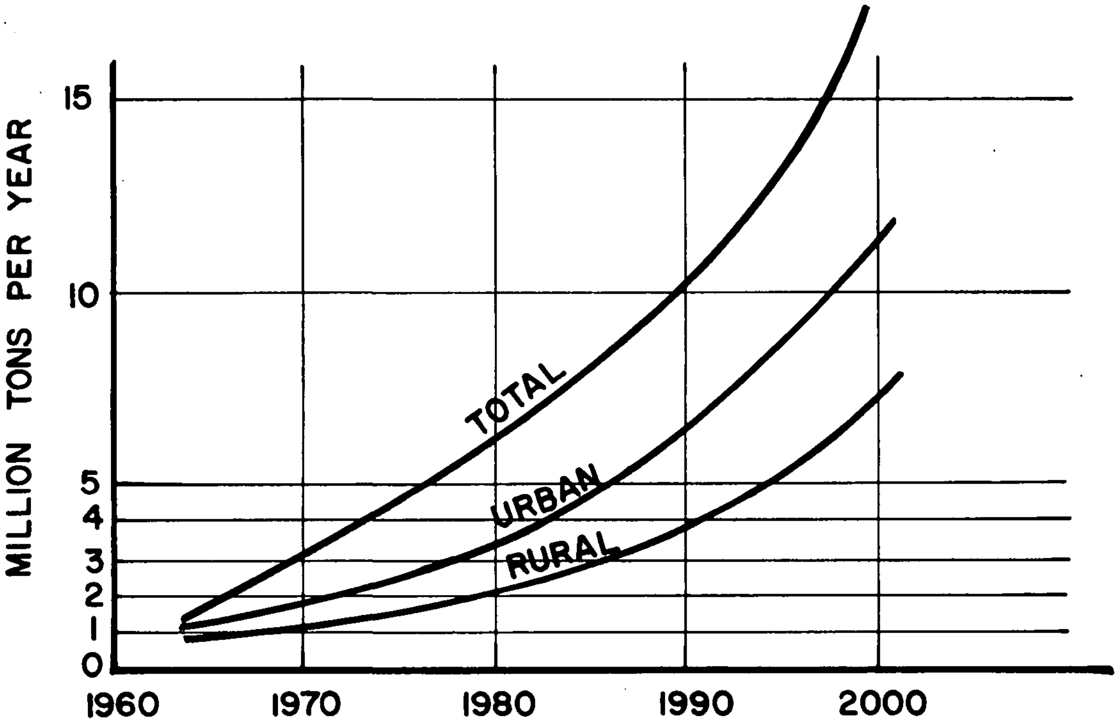

Figure 4. TOTAL SOLID WASTE IN MARYLAND

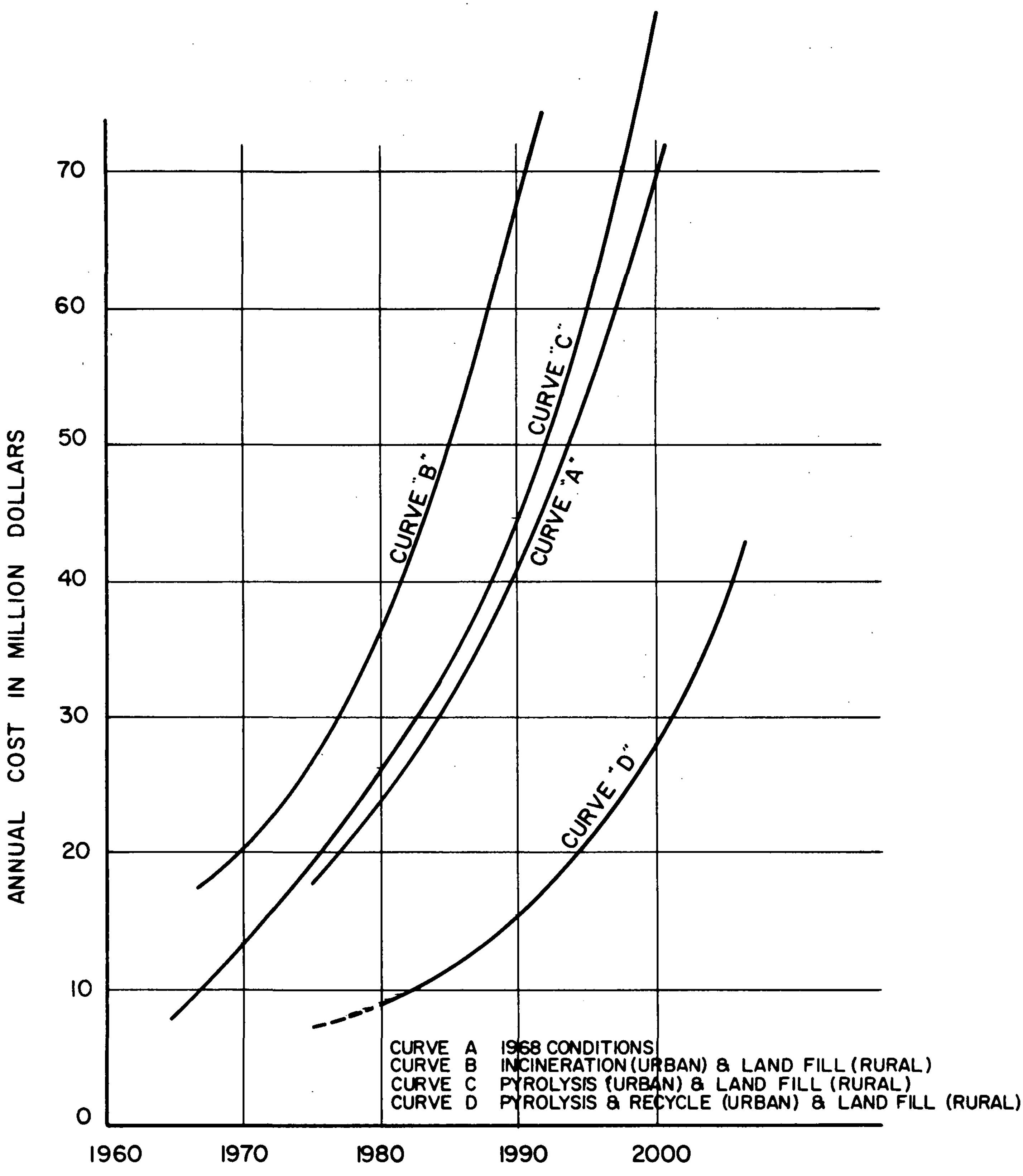

Figure 5. **SOLID WASTE**

ESTIMATED COST IN MARYLAND

some other means. This is a clear indication that additional pyrolysis plants and/or incinerators will be needed in Baltimore alone just to keep up with the demand, since there will be virtually no landfill area available by 1975. The cost curves (Fig. 5) indicate that pyrolysis and recycling is the way to go in urban areas. It is anticipated that land filling and recycling will generally keep pace with demands in rural areas.

The disposal and handling of hazardous wastes such as toxic chemicals, drugs, infectious materials, poisonous plants, incendiary material and radioactive materials was discussed in some detail under Section II D - "Hazardous Waste Survey" of the report of January 1971 by the Environmental Quality Committee, entitled "Some Technology Considerations For Environmental Quality in Maryland." That report recommended that the State undertake an initial survey of hazardous wastes to develop an index of hazardous materials and analyze the problems of their collection and disposal. The report also recommended that this be followed by an annual survey to monitor changes in the situation. Since the problem of hazardous wastes may be even larger now than it was in 1971, and since the State has initiated no independent study of the problem, the recommendations of the January 1971 Report are again pertinent.

Another solid waste disposal problem is that of sludge produced by the various sewage treatment plants throughout the State. According to data furnished by the Maryland Environmental Services, Maryland produces between 462, 300 and 535, 350 pounds per day of dry sludge. In addition, the District of Columbia produces about 400, 000 pounds per day. The latter will be dried and incinerated in a plant now under construction at the site of the Blue Plains Sewage Treatment Plant. There is also a sludge drier at the Baltimore Back River Sewage Treatment Plant, but all other sludge is simply dried by spreading on beds at the various treatment plants. Its ultimate disposal is a problem because it is not yet economically feasible to use as a soil nutrient, although this is an obvious method for ultimate disposal that would be compatible with ecological considerations. The volume of dry sludge will increase as time goes on and may be expected to accelerate as more stringent water control standards are applied.

An article in the October 30, 1972 issue of "Commerce Today" cites the fact that industry is gearing up to meet the new solid waste disposal challenge. It quotes the National Industrial Pollution Control Council as recommending on a National scale the need for:

> "Better information on sources of industrial solid waste, including identification of the sources and the quality and quantity of that waste, as well as changes in production of industrial manufacturing solid waste. (NIPCC would possibly form the framework for such an investigation.)

Better definitions of industrial solid waste problems, either as they now exist or are anticipated, together with a better estimation of the impact of pollution control legislation in order to set priorities.

A first priority to be given to the disposition of hazardous and toxic materials because of their double health-environmental implications.

Better evaluation of regional processing and disposition of industrial solid waste, because of its potential advantages.

Enactment and enforcement of solid waste codes that are on an equal basis both nationally and locally. Information on nonuniform enforcement of these codes should be brought to the attention of Local, State and Federal agencies.

More incentives to recycle waste materials for reuse or for stockpiling; such as, an equivalent of the depletion allowance provided in the tax structure for virgin materials.

An investigation of the economic impact of water and air pollution controls on small organizations and marginal producers to provide a dependable and quantitative basis for decision-making on standards, variances and compliance assistance.

Encouragement of collective pooling of research and development efforts where problems are industry wide and inherently beyond the financial capability of any one component of an industry.

NIPCC encouragement of the Environmental Protective Agency to facilitate the dissemination of information on acceptable and economic solutions to industrial solid waste pollution problems."

A similar approach must be fostered by the State of Maryland. This Subcommittee suggests that:

a. "Solid Waste Regions" as recommended by the State Department of Health and Mental Hygiene be established so as to enable solid waste collection and disposal to be more economically accomplished through more workable systems that would serve several political subdivisions simultaneously.

b. Examine local laws concerning permit requirements for disposal of solid wastes in landfills.

c. Develop more stringent requirements concerning the disposal of certain problem items such as cars, tires, animals, etc.

d. Develop more tax incentives or "bounty" systems to encourage recycling and other methods for reducing the volume of solid wastes.

e. Promote recycling of incinerator wastes from existing incinerators by giving financial assistance to local subdivisions for this purpose, as was recommended in the previous report of the Environmental Quality Committees of the Governor's Science Advisory Council.

f. Utilize the latest technological disposal techniques such as the pyrolysis system of Baltimore, and the use of solid waste and organic sludge as fuel for development of power as in the PEPCO-Dickerson Power Plant in Montgomery County.

g. Create a study of hazardous wastes as recommended in the previous Committee report.

h. Continue a program to monitor and evaluate and make use of on-going pilot programs set up by private industries and others. Some of these pilot programs are:

(1) American Cyanamid Company's program for solid waste problems including (a) buying raw materials in bulk thus eliminating the problem of thousands of bags and other packaging (b) burning solid wastes as a fuel in its heating plants.

(2) The Campbell Soup Company's program for solid waste problems for disposal of byproducts and other solid wastes.

(3) Various glass companies such as Brockway Glass Company and the Kerr Glass Manufacturing Corporation have instituted recycling programs for glass.

(4) Certain paper and paper products companies such as Alton Box Board Company and the Container Corporation of America have instituted recycling programs for waste paper fiber. The latter is also participating in a pilot project in Chicago to determine the feasibility of municipal collection of old newspapers.

(5) Certain companies have developed systems of recycling solid waste to reduce it to organic compost fertilizer.

(6) General Motors' plant at Pontiac Michigan uses waste paper and trash as a primary fuel in their plant.

This subcommittee believes that the technology exists to solve the general problem of solid waste disposal in Maryland, and that by applying that technology now, considerable cost savings can be realized. It is evident that disposal of solid wastes in the urban areas, particularly around Baltimore and the District of Columbia, has reached critical proportions and will get worse if steps are not taken now. It is also evident that by recycling materials and recycling energy by using the solid waste disposal process as a source of power, the future cost of disposal may be decreased significantly.

We are confident that the solid waste disposal problem in Maryland can be handled technically and economically provided the Administrative and Legislative branches of the State of Maryland act soon to implement the options available.